THURSDAY, AUGUST 13, 1914.

AGRICULTURAL BACTERIOLOGY.

Vorlesungen über landwirtschaftliche Bakteriologie. By Dr. F. Löhnis. Pp. viii + 398 + x plates. (Berlin: Gebrüder Borntraeger, 1913.) Price 16 marks.

MODERN research has established the manifold activities exerted by micro-organisms in almost every department of agriculture and the attention of micro-biologists has naturally been directed to a study of the micro-organisms present in soil which influence its fertility, and of those met with in fodder and manure and in agricultural products such as milk, butter, and cheese. The result has been that many books dealing with these subjects have appeared during the last few years, but we doubt if any single volume has been issued which will compare with that under review in the completeness with which agricultural bacteriology is treated in a comparatively short space of five and twenty lectures. Prof. Löhnis has managed to convey an admirable summary of the whole subject.

The volume commences with an excellent historical introduction in which the author directs attention to papers by E. King, published in 1693, in the Philosophical Transactions of the Royal Society, London (vol. xvii), which seem to have been overlooked and which confirm and extend the observations of Leeuwenhoek on the presence of micro-organisms in various organic fluids. The second and third lectures deal with the general morphology, classification, and nomenclature of the bacteria. The author adopts practically the old Zopf classification, remarking that no better one has yet been formulated; with this we cordially agree. Succeeding lectures deal with the biology, cultivation, and investigation of micro-organisms, the circulation in nature of nitrogen, carbon, hydrogen, and oxygen, exchange and decomposition of mineral salts, and the pathogenic functions of micro-organisms, and this completes the first part of the volume. The second part deals with micro-organisms present in fodder, milk and milk products, manure and soil, and the changes which they produce. In this we find accounts of the cellular elements in milk, the heating of manure and hay, nitrification, the possible influence of protozoa and of "toxins" in the soil on fertility, and the use of artificial bacterial fertilisers. In the last connection we miss any reference to Prof. Bottomley's investigations.

The volume is excellently printed and produced, and the illustrations form a striking feature. There are ten plates, of which eight are coloured and admirably depict the objects represented, one of the most successful perhaps being that of a sole glowing with phosphorescent bacteria, a most difficult subject to reproduce. There are sixty figures in the text, some of which are novel. By depicting a rectangular jar of given size with a small black square in it drawn to scale an idea is given of the volume occupied by a certain number of bacteria compared with the volume of the material in which they occur, such, for example, as milk. R. T. H.

THE CONSTITUTION OF ALLOYS.

Metallographie. By Dr. W. Guertler. Erster Band: *Die Konstitution.* Erster Teil. Heft i.–xii. Pp. 1177. (1909–1912. Zweiter Teil.) Heft. i., *Die Konstitution des Systemes Eisen-Kohlenstoff sowie der sonstigen binären Kohlenstofflegierungen.* Pp. xl + 648 + plates. (Berlin: Gebrüder Borntraeger, 1913.) Price 32 marks.

THE scientific study of alloys has attracted a whole host of investigators during the last twelve years, and the mass of experimental material has increased with great rapidity. Metallography has become a distinct branch of applied physical chemistry, having numerous contacts with mineralogy and with engineering science. There are many text-books dealing with the principles of metallography or with its applications, but the work now in course of publication by Dr. Guertler has a much wider scope. It aims at being a complete treatise on the subject, reviewing critically both methods and results, and also serving as a work of reference. The practical methods of thermal analysis, micrographic examination, etc., and the physical properties of alloys, are left for discussion in later volumes, and the volumes now published deal only with the equilibrium of phases in alloys. The general explanation of the meaning of the equilibrium diagram has been written with the object of making such diagrams intelligible and useful to the technical metallurgist, who may not be acquainted with the principles of physical chemistry. This general account is very clearly written, but the number of new terms introduced, and the rather complicated illustrations of possible forms of equilibrium, may repel some such readers. The discussions of such subjects as diffusion and incomplete equilibrium are excellent.

Just one-half of the first of the present volumes is occupied by a detailed account of binary alloys, classified according to a modified periodic system. Even then, the alloys of the calcium and aluminium groups are postponed to a later section,

together with all the ternary alloys and systems of a higher order. The second volume now under notice deals almost exclusively with the iron-carbon system.

Dr. Guertler has thus undertaken an immense task, and has shown marvellous industry in the sifting and presentation of so large a mass of material. The published data referring to each system have been critically reviewed, temperatures have been reduced as far as possible to a uniform scale, and the equilibrium diagrams in which the author embodies his conclusions represent a large amount of patient labour and acute criticism. It is impossible, however, to escape a doubt whether so great an undertaking is justified in the present state of the science. It is well known that very many of the published investigations on this subject have been carried out with rough experimental methods and impure materials, and can only be regarded at best as preliminary surveys. Even the author's critical examination of the data cannot bring conclusive results out of such material. At the present time many of the binary systems are undergoing re-examination by competent investigators, often with surprising results, and for some years to come any systematic account of metallic alloys must be regarded as merely provisional. Such a work as the present is inevitably out of date before its publication is complete. This being admitted, however, all metallographers must be deeply grateful to Dr. Guertler, who has provided them, in a compact form, with a carefully sifted collection of experimental data, otherwise difficult of access, enriched with comments of a thoroughly sound and practical character.

It is an astonishing fact that six hundred pages are required to give an account of the equilibria in a single binary system, that of iron and carbon. The volume devoted to these alloys leaves out of consideration the whole field of the technical treatment of iron and steel, of their physical and mechanical properties, and of the influence of other elements on the system. Probably no better guide than the author could be found through the controversial mazes of this part of the subject, and his conclusions are to be received with all respect. The recent revolutionary proposals of Wittorf and others are subjected to a searching analysis, leading to the conclusion that cementite, Fe_3C, has a range of stability above 1700°, graphite being the stable solid phase between 1700° and 1360°, whilst the existence of a further carbide, Fe_4C, with a small range of stability, is regarded as probable. The thorny subject of the nature of martensite and troostite receives very full treatment, but on this point it would be difficult to find two metallographers who are in complete agreement, and the author's views are not likely to escape criticism. Ingenious diagrams, sometimes having the curves corresponding with metastable equilibria printed in colours, are used in this volume, which is indispensable to all who are seriously interested in the constitution of cast-iron and steel.

The book is admirably printed. In the course of constant use few misprints have been detected, with the exception of proper names, which are rather frequently mis-spelled. References are only given by author's name and year of publication, the details having to be sought in a bibliography, which is to appear on the completion of the work. In the first volume it would have been of advantage to provide a larger number of photo-micrographs in some sections, but those which are included, most of which are fairly familiar, are well reproduced. The second volume is profusely illustrated. C. H. DESCH.

ZOOLOGY, EMBRYOLOGY, AND HEREDITY.

(1) *Handbuch für Biologische Uebungen.* By Prof. P. Röseler and H. Lamprecht. Zoologischer Teil. Pp. xii + 574. (Berlin: Julius Springer, 1914.) Price 27 marks.

(2) *Konstitution und Vererbung in ihren Beziehungen zur Pathologie.* By Prof. F. Martius. Pp. viii + 258. (Berlin: Julius Springer, 1914.) Price 12 marks.

(3) *Leitfaden für das Embryologische Praktikum, und Grundriss der Entwicklungslehre des Menschen und der Wirbeltiere.* By Prof. A. Oppel. Pp. vii + 313. (Jena: Gustav Fischer, 1914.) Price 10 marks.

(4) *Studies in Cancer and Allied Subjects.* Vol. iv., Contributions to the Anatomy and Development of the Salivary Glands in the Mammalia. (Conducted under the George Crocker Special Research Fund at Columbia University.) Pp. v + 364 + plates. (New York: Columbia University Press, 1913.) Price 5 dollars net.

(1) THIS handbook appears to be meant specially as a guide to teachers who have to conduct courses of practical instruction in zoology in higher schools and colleges, but whoever works conscientiously through it, whether a prospective school teacher or not, will have gone through an excellent course in practical zoology on the "type" system. He will have given himself a practical training of a much sounder and more extensive kind than is, we fear, commonly attempted by those who have to conduct such courses in the schools of this country. We fancy that if our science masters had to work through

a course such as is given in the book now under notice we should find them teaching in their turn something rather different from what so frequently, with us, masquerades under the name "nature study."

The opening chapters of the book are of a general nature. A useful inventory of laboratory requirements is followed by practical directions regarding the use of the microscope. Methods of observation of the living animal are described, and thereafter the technique of fixing, staining, section-cutting, and so on. A chapter on general histology gives good practical directions for obtaining the various types of tissue, and that is followed by a chapter on physiology, with good practical exercises dealing with digestion, respiration, milk, blood, and urine.

About four-fifths of the book are taken up by special exercises upon representatives of the various main groups of the animal kingdom. In the chapter on protozoa the sporozoa as exemplified by Gregarina and Monocystis are taken first, then flagellates and ciliates, while our old friend Amœba comes last. This is a reversal of the usual order, and its advantage seems to us very questionable, for, whatever unexpected complexities may turn up in the life-history of *Amoeba proteus*, the fact remains that the ordinary phase in the life-history, which alone is studied in practical classes in zoology, represents an extraordinarily simple and unspecialised type of animal—quite without a rival as a subject of study for the beginner in zoological science.

The chapter on Cœlenterata deals with a couple of sponges, Leucandra and Spongilla (why not a simple Ascon?), Hydra (we notice its cœlenteron is miscalled cœlom!), *Obelia geniculata* (the figure of the hydroid phase appears to represent another species), Aurelia, Nausithoe, Actinia, Alcyonium, and Corallium. Chapters on worms, arthropods, molluscs, echinoderms, tunicates—each deal with various representative members of the group; while vertebrates are illustrated by Amphioxus, Petromyzon, Scyllium, Leuciscus, Rana, Lacerta, Columba, Lepus.

It will be seen that the book covers a very wide area and on the whole it does it well, although necessarily some of the descriptions are very short. Both in the introductory chapters and scattered throughout the book are to be found hints on technique valuable even to those who have considerable experience. The book is amply illustrated, though the illustrations vary much in quality. Some are excellent, for example, those of Astacus and Hirudo (the latter after Hatschek and Cori's beautiful figures); while others, such as that of the transverse section through the earthworm, are very rough. The figures of Ascaris eggs should also be revised for a future edition. On the whole we find the book wonderfully free from gross errors, and we think it will be very useful to students.

(2) This book, with its quaint expressive literary style, and its occasional flashes of humour, forms a very readable section of the Enzyklopädie der klinischen Medizin. The first half of the book is devoted to emphasising the importance of the individual constitution as a factor in disease. The two extreme schools of thought on this subject are referred to: on one hand, the extreme bacteriologists to whom the body is little more than a test-tube containing nutritive medium in which the inoculated microbe can grow and multiply, and to whom the mere mention of the word constitution is looked upon as an attack upon their science; and on the other, the extreme constitutionalists, some of whom have gone the length of looking upon germs as the mere harmless accompaniments of illness.

The second half of the book is devoted to heredity in relation to pathology. Chapter iii. gives a crisply written and, on the whole, fair-minded summary of the theory of heredity and of the main facts of cytology related to it. The author's attitude is eminently common-sensible, and shows a width of view difficult of attainment by the specialist in the study of heredity. He gives full credit of the enunciation of the main idea of the continuity of the germ plasm to Galton in 1875, *i.e.* before both Jäger and Weismann. Due space is given to Mendelism. We notice the verb "mendeln," and the substantive "Nichtsals-mendelianer," though we miss the suggestion of still further developments of the vocabulary on the lines of mendelacious, mendelacity, mendelinquency, mendelette, and so on. The final chapter, which might with advantage have been longer, gives a summary of some of the more important facts of observation in pathology and teratology in relation to heredity.

(3) The author of that admirable encyclopædia entitled the "Lehrbuch der mikroskopischen Anatomie," has in the work now under review succeeded in writing an uncommonly dull book upon an uncommonly fascinating subject. The way in which the book opens—with the sentence "Das volkommenste Forschungs- und Unterrichtsmittel, über welches die beschreibende Embryologie heute verfügt, besteht darin, dass ein Embryo in eine Reihe von dünnen Schnitten zerlegt wird, welche mikroskopisch untersucht werden können"—illustrates admirably the character of the whole work, which is typically

German in its combination of trustworthiness in regard to detail, with almost complete absence of that wide "grip" which makes a work, or a worker, a living force in the development of the science.

Chapter i. sketches the objects and general method of a course in practical embryology; chapter ii., consisting of less than a page, is entitled "Embryology and 'Entwicklungsmechanik'"; chapter iii., about half a page in length, has the somewhat ambitious title, "Evolution, Epigenesis, Neo-evolution, Neo-epigenesis." After this it is somewhat startling to find that chapter v., "On some of the causal factors of development," which teaches the student various excellent Rouxian expressions in which his—and his teacher's—ignorance may be safely wrapped up, extends over some eight pages. Many long and Greek-looking words occur in this chapter, and we confess to being not altogether convinced that they serve a useful purpose. We do not quite see of what special advantage it is to a German student—apart from some slight economy in time or ink—to refer to the wandering apart of cells which had come together as "Cytochorismus," instead of using the expressive vernacular "Wiedervoneinanderlösung." Technical terms are, of course, very necessary things, but there is often a danger—and it is one from which biological science is suffering greatly at the present time—that the affixing of a new technical name may be counted as *explaining* a natural phenomenon, or as making at least a definite step towards explanation.

The first section of the book is completed by a short but good account of simple embryological technique suitable for elementary students, followed by a short sketch of developmental mechanics and a syllabus of work for a course in practical embryology.

The second section of the book gives a good, though rather too short, general account of germ cells, early stages in development, and fœtal membranes. The third section gives directions, illustrated by outline drawings, for working through series of sections of various vertebrate embryos, while the concluding section of the book gives a short but good sketch of vertebrate organogeny.

The book is excellently illustrated. It is too short, and it has, as we have indicated, other faults, but it is, on the whole, trustworthy, and will, we doubt not, serve its purpose to the student who hustles through a course in vertebrate embryology with the idea of picking up some knowledge of its methods rather than of becoming acquainted with its general principles as a branch of evolutionary science.

(4) Vol. iv. of the "George Crocker Studies in Cancer and Allied Subjects" consists of a series of eight valuable memoirs upon the anatomy and development of the salivary glands of the mammalia. Adult anatomy is dealt with by Carmalt (man, carnivora, ungulata, rodentia, insectivora, marsupialia) and Huntingdon (lower primates); embryonic development by Schulte (man, cat, pig); while the evolution of the primate salivary glands out of the presumably ancestral condition of a diffuse gland-field is discussed by Huntingdon. Taken altogether the volume forms a valuable addition to our knowledge of the morphology of the salivary glands of the mammalia, and incidentally it affords a striking tribute to the wise and broad-minded administration of the George Crocker Research Fund of Columbia University.

TROPICAL PRODUCTS.

(1) *The Cultivation of the Oil Palm. Some Essential Notes.* By F. M. Milligan. Pp. xiv + 100. (London: Crosby Lockwood and Son, 1914.) Price 2*s.* 6*d.* net.

(2) *Rubber: Its Sources, Cultivation, and Preparation.* By Harold Brown. With a Preface by Dr. W. R. Dunstan. Pp. xiii + 245 + xii plates. (London: John Murray, 1914.) Price 6*s.* net.

(3) *The Banana: Its Cultivation, Distribution, and Commercial Uses.* By W. Fawcett. With an Introduction by Sir Daniel Morris. Pp. xi + 287 + plates. (London: Duckworth and Co., 1913.) Price 7*s.* 6*d.* net.

THE trio of books under notice deal with three important tropical products, the first being chiefly associated with European colonies in western equatorial Africa, the other two being widely exploited.

(1) The luxuriance and abundance of the oil-palms in the coastal lands from Sierra Leone to the Cameroons furnish good evidence that the climate is particularly suitable and that the tree is well able to hold its own against plant and insect pests. The supply of fruit and nuts was originally obtained from wild plants, but plantations have been formed by natives and are being extended. Undoubtedly there is scope both for extended planting and for more careful cultivation. It is with the object of offering advice in these matters that Mr. Milligan has written his book. Unfortunately, although there are many allusions to his experience, the information given is exceedingly meagre; on the subjects of seed-germination, planting, and manuring, the advice is sound, but in other respects, notably as regards botanical details, the information is not only insufficient, but incorrect. The subject of oil-production is not included.

(2) The present time is very opportune for a review of the plants and methods connected with rubber production. During the last few years a number of outstanding problems have been critically determined or investigated, primarily by planters and agricultural officials in the producing countries, and, to a less degree, by workers in museums and laboratories. Thus there is a fairly general agreement with respect to the limitations of climate required by the Para rubber tree, *Hevea brasiliensis* and the Ceara rubber tree, *Manihot glaziorii*, and the sources of the various native-prepared rubbers; also opinions have gradually crystallised with regard to the best methods of tapping Hevea, the different requirements for Manihot, the African rubber tree, *Funtumia elastica*, and other trees, and the various methods of producing coagulation of latex. On all these matters Mr. Brown provides a valuable mass of recorded observations and sifted conclusions, together with summaries of quantities of latex obtainable and analyses. Two chapters are devoted to the rubber industry in British Africa and the principal rubber-yielding plants. The chapters on latex, tapping, preparation, and chemistry of rubber are particularly interesting because the author is specially qualified to write on these subjects. With reference to the botanical determinations of the various species of Landolphia, Manihot, and Ficus, reference is made to the sources from which the data are collated. The book is certainly one of the most useful contributions to the subject of rubber production; not the least interesting paragraph is that in which an opinion is given as to the competition with synthetic rubber.

(3) The greater part of Mr. Fawcett's book on bananas is occupied with an account of the cultivation of the banana in Jamaica, its dietetic value and by-products and the development of the banana trade. The chief points treated in connection with cultivation are details of the plant, flowers and fruit with illustrations, the pruning and treatment of suckers—a very complex and important matter—mulching, fertilisers, diseases, and pests. The later chapters are devoted to a comprehensive review of the cultivation of different species and varieties of bananas and plantains throughout tropical countries, including India, Queensland, Egypt, Natal, various African colonies, and States in Central and South America. Into many of these the Jamaican and Canary banana plants have been introduced for cultivation; the former is a variety of *Musa sapientum*, known as Gros Michel, that originated as a sport in Martinique; the latter is *Musa cavendishii*. The Jamaican banana is better fitted for transport, but the plant is liable to be wrecked by strong winds. Attention is directed to the by-products, dried bananas, known as "banana figs" and banana flour, also to the cooking recipes. The book is recommended as a comprehensive and authoritative compilation, characterised by clearness and accuracy. An item of special botanical interest is the list with chief characters of sixty-six species of Musa.

ENGINEERING MANUALS AND TEXT-BOOKS.

(1) *Suspension Bridges, Arch Ribs, and Cantilevers.* By Prof. W. H. Burr. Pp. xi+417. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1913.) Price 19*s.* net.

(2) *Technical Mechanics, Statics, and Dynamics.* By Prof. E. R. Maurer. Pp. vii+356. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1914.) Price 10*s.* 6*d.* net.

(3) *Mechanical Refrigeration.* By Prof. H. J. Macintire. Pp. ix+346. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1914.) Price 17*s.* net.

(4) *The Human Factor in Works Management.* By J. Hartness. Pp. ix+159. (New York: McGraw-Hill Book Co.; London: The Hill Publishing Co., 1912.) Price 6*s.* 3*d.* net.

(5) *Elasticità e resistenza dei corpi pietrosi Mattoni, Pietre, Malte e Calcestruzzi, Murature.* By Ing. Alfredo Montel. Pp. vi+180. (Torino: S. Lattes and Co., 1914.) Price 5 lire.

PROF. BURR is so well known as a writer on bridges that another work from his pen will be welcomed by engineers, particularly as he deals with the problems connected with large suspension bridges, about which he is particularly qualified to speak as a consulting engineer. The problem of the stiffened suspension bridge in general is dealt with in an exhaustive manner, preceded by a treatment of the perfectly flexible cable or frame loaded vertically. A useful table is given for the lengths of cables assuming a parabolic form, an assumption which is generally made by engineers in designing, for the loading is so nearly uniform per unit of length of span that the catenary is almost the same as the parabola. This leads to an interesting deduction as to the approximate greatest length of span for different ratios of central deflection of cable to span. Thus, taking 60,000 lb. per sq. in. as the working stress for steel wire and the above ratio 10, we find that a span of 13,740 ft. is possible. The friction in the joints of a link cable is shown, and the stresses due to friction in the pins of eye

bars become larger than is generally supposed, and the resulting bending moments are by no means negligible. The theory of the straight stiffening-truss based upon the elastic deformation of the structure assumes that there is no sensible variation from the parabolic form of cable or frame. The thermal stresses in stiffened suspension bridges are discussed. This work should find a ready acceptance among engineers and students alike.

(2) It is not surprising that this work has reached a third edition in ten years for it possesses distinct merit and originality. Unlike the usual text-book on mechanics which is compiled by rigid adherence to academic method, it has a treatment all its own, and one that will commend itself alike to teachers and students who have left the abstract for the concrete problems met with in practical application. The author asserts that it is neither theoretical mechanics on one hand, nor applied on the other, since it does not include strength of materials, and the reader will not go far before discerning a judicious blend between the two extremes. The thirteen chapters comprise statics, friction, centre of gravity, rectilinear and curvilinear motion, translation and rotation, and work, energy, and power. The illustrations are clear and essentially represent objects familiar to the engineer.

(3) A short introductory chapter to this volume is devoted to the usual thermodynamic relations for air and other vapours, after which the various types of refrigerating machines and their construction are described. This is followed by the theory of refrigeration and the choice and properties of refrigerating mediums. We then find a chapter on testing refrigerating machines, followed by a discussion on insulation; and finally, the various commercial applications are dealt with. The discussion on refrigerants has been brought up to date by including the work of Mollier and others. The descriptions of refrigerating plant and methods are very complete.

(4) A perusal of this work will leave the reader in doubt as to the object of the writer, and yet he will conclude that it is an interesting and pleasantly written essay upon the motives and habits of the workman in the pursuit of his work. As human nature is the same the world over, it will doubtless be found to meet the characteristics of the English as well as the American workman, and perhaps to suggest to the employer some of the causes which have operated to give a nation a certain place in the industrial world. To American managers who have given the problems of works management a position among the sciences it would make a direct appeal, and though most men of experience would find their views in general accord with those of the author, it is pleasant to find them confirmed by one who has evidently a clear and shrewd apprehension of the actuating forces that underlie all human endeavour. We would however be inclined to say *ça va sans dire* to much that the author has written. For instance, few will find fault with the statement that inertia is not confined to an inanimate mass and that it has to be overcome in a progressive business. Notwithstanding the somewhat trite remarks that we find throughout the work, there is a distinct charm about the manner of presentation, and as the author confesses to a feeling of incompleteness in the treatment, we must take what he has given us with this reservation and accept his contribution to a very large subject capable of indefinite variation.

(5) This work on the strength and physical properties of bricks, stone, mortar, cement, and masonry is a compilation of results of experiments with a discussion of the theory of elasticity as applied to such materials. The first chapter deals with the elastic properties in reference to Hooke's law and Poisson's ratio for the materials, and in the second the behaviour of materials under compression is dealt with, which is followed by a chapter on the flexure of beams. The ordinary tensile tests on various kinds of cement are described and the results tabulated. The strength of bricks based upon various experiments made by different men is, in view of the variable character of the material, of special interest, also the crushing strength of building stones of different kinds is given. The chapter on the crushing strength of brick piers is of special value as so little has been done in this direction, chiefly owing to the inherent difficulties of testing and rendering the results comparative. The effect of the quality of the bricks and mortar and the workmanship is discussed, the results obtained by Popplewell, Howard, and others being cited. The thickness of the joints, leading dimensions, and other possible variations in the test piers make it impossible to lay down any absolute laws as the result of the tests. The work ought to be of use to engineers as a guide to what has been done in a very large subject.

OUR BOOKSHELF.

Minerals and the Microscope: an Introduction to the Study of Petrology. By H. G. Smith. Pp. xi + 116 + xii plates. (London: Thomas Murby and Co., n.d.) Price 3*s.* 6*d.* net.

THE author of this convenient and systematic little treatise is Demonstrator of geology in the Imperial College of Science, London, where he has gained

experience through the introduction of large classes to the use of the microscope in petrology. The style is clear, and sufficient optical theory is introduced to add interest to determinative methods. The philosophic processes by which minerals are determined, affording as they do an insight into crystalline structure, are of far more value in class-work than actual specific identifications. The beautiful series of photographs of minerals as they appear in thin rock-slices is a very welcome feature, and gives special distinction to the book.

As an "introduction to petrology" the microscopic method often fails; this is seen, for instance, where the author (p. 103) regrets the difficulty of distinguishing the triclinic felspars present in a granite. Surely, in a coarse-grained rock, a fragment broken from the mineral will supply material for other than optical tests. We do not know, again, how "microscopic investigation should always enable the student to make the distinction" (p. 112) between foliation and bedding, seeing that the two so frequently coincide in schists. But Mr. Smith has given us the handiest and best illustrated introduction that we possess to an important aspect of rock-minerals, and has even included a coloured plate of Newton's scale. If the student remembers that every rock-section has its parent rock, he may well place himself at an early stage of his work under the guidance of these lucid pages. G. A. J. C.

Researches into Induced Cell-reproduction in Amoebae. By J. W. Cropper and A. H. Drew. Pp. 112+plates. (The John Howard McFadden Researches, Vol. IV.) (London: John Murray, 1914.) Price 5*s.* net.

THE investigations described in this volume were undertaken with the view of supporting the theory of H. C. Ross, that cell-reproduction is brought about by certain chemical agents termed "auxetics," and that their effect is increased by the addition of other substances known as "kinetics." The authors claim to have confirmed this theory, and to have shown that the mode of action of these substances is probably through the medium of enzymes. The presence of these agents in the environment is stated to produce variations in the morphology of the organism. Methods of cultivation of amœbæ and their examination by the "jelly method," are described. The encystment of an amœba is stated to be due to the action of certain deleterious bacterial products, and it is claimed that the subsequent excystation is caused by other products which act on the cyst-wall from without, and are of the nature of ferments. A detailed account is given of the preparation of cultures of the amœba with pure strains of different bacteria. The amœba used in these researches was a species found by the authors living in a solution of sodium chloride (1 per cent.) and sodium citrate (3 per cent.) in the laboratory, and named by them *Amœba ostrea*. A parasitic micrococcus, which was very deadly to the amœba, was also isolated and investigated.

Song and Wings: a Posy of Bird Poems for Young and Old. By Isa J. Postgate. With a Preface by the Rev. Canon H. D. Rawnsley. Pp. xi+50. (London: Alexander Moring, Ltd., 1914.) Price 2*s.* 6*d.* net.

MISS POSTGATE'S pretty verse will serve a very useful purpose if, by arousing an interest in birds and bird-life, it assists in the arrest of the extermination of beautifully plumaged birds for the gratification of the desire for barbaric adornment fostered by modern fashion.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Asymmetric Images with X-Radiation.

CONFIRMING our letter of July 16 on asymmetric haloes, we have found that the bands can be produced on one, *two adjacent*, three, or all sides of a square (lead), and when an obstacle is placed at or over one side the corresponding band only vanishes. These effects are independent of the incidence of the radiation. With V-shaped aperture, the apex resting on the plate, the bands on one side are sharply defined, and twice bent; on the other there are several, and they are diffuse and fainter.

The double bend is due to the fact that within a short range two edges contribute as in light.

With strips (steel), say, 4 cm. width, the white bands *cross* at various angles depending on the slope to the plate, but are afterwards dispersed at short distances from the edges they approach.

The diametric asymmetry excludes polarisation, and since it increases directly with the distance from the axis through the "optimum" (*i.e.* 15° from the direction at which light would be reflected) the rays must have some determination from the plane of the anti-kathode. In other words, they must be "polarised" in planes at successive angles to the direction of propagation. The continuance of the bands within the shadow beyond the range of light diffraction and their varying asymmetry show that X-radiation is something more than light of very short wave-length, or otherwise light itself must possess unequal polarity in its structure.

I. G. RANKIN.
W. F. D. CHAMBERS.
90 Gordon Road, Ealing.

Unit of Acceleration.

IT is a little surprising to find in Dr. Shaw's paper (December 16, 1913), ". . . He (Mr. Whipple) points out that we have no special name for the unit of acceleration." In NATURE of June 25, 1914, Mr. Whipple proposed the name "leo." So long ago as 1909 Wiechert used the term "gal" in the report for the Göttingen earthquake station for that unit, being the first syllable of Galileo, whence Mr. Whipple derives his "leo." Others, as well as myself, have used "gal," or rather "milligal," in analyses of earthquakes. A milligal is approximately a millionth of *g*. Dyne is the unit of force, gal the unit of acceleration.

OTTO KLOTZ.
Dominion Observatory, Ottawa, July 18.

THE NESTING HABITS OF ADÉLIE PENGUINS (PYGOSCELIS ADELIÆ).

WHEN they arrive at the southern rookeries in the early spring, the penguins appear to be quite unattached, and pairing takes place during the ensuing week or two. As they spend the winter on the floating pack ice, far out to the northward, they have a journey of some hundreds of miles to get to their rookeries, and are therefore much fatigued on arrival. Consequently, many are seen to spend their first day or so in resting, either on the sea ice, or on the solid ground on which the rookery is formed.

The hens betake themselves either to old nests, or else scrape little scoops in the ground, which they previously thaw by squatting on it for a short time. They sit in these scoops, and wait until mates come to them. Were they not very jealous of one another, the cocks might easily get mated and start domestic life without any trouble. Unfortunately, however, the jealousy which characterises the animal kingdom in general when engaged in matrimony, is ingrained in the character of the Adélie cock in its most violent form, so that bands of these little warriors are to be seen all over the rookery, watching each other's every movement, and hindering one another in their quest for wives. As soon as one of their number approaches a hen, one or more of his companions sails in at him, and a desperate battle takes place, each bird raining in blows with his powerful "flippers," and fighting with the most indomitable bravery. As a rule, after some preliminary squabbling, two of the band are seen to settle down to a serious encounter (Fig. 1), in which each uses his weight, leaning his breast against his opponent, so that as one begins to outlast the other the weaker bird gets rushed out of the crowd, and the fight ends on some open patch of snow, when the victor has his enemy down, and hammers him until he cannot rise or beats a retreat.

After this the conqueror returns to the hen, and as likely as not fights another of the band. Thus hours may be spent over the winning of a sirgle hen. At length there seems to be an agreement that one of the knights has established his right to the lady. As a rule, it is the strongest and cleverest fighter of the group; but, curiously, this is not always so, as sometimes the bird who has undoubtedly proved himself the victor suddenly walks off, and by general consent his vanquished opponent is left in possession of the field.

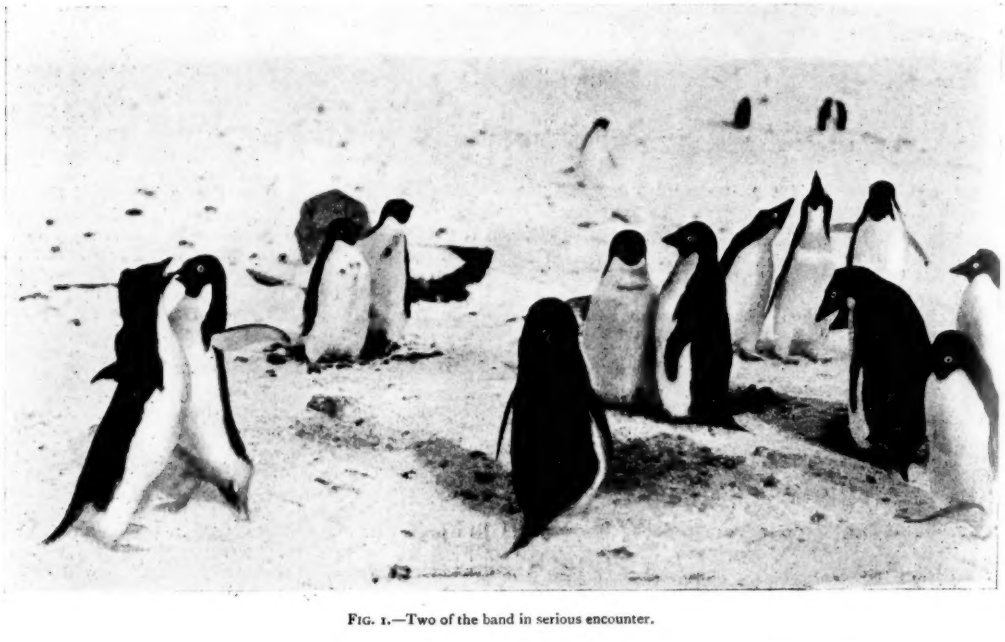


FIG. 1.—Two of the band in serious encounter.

His troubles are not yet ended, as the hen has yet to make up her mind that she will have him. His first overture very often takes the form of an offering in the shape of a pebble for the nest. This he lays in front of her, and it may suffice; but often it does not, and she responds by pecking him furiously, whilst he hunches himself up, with closed eyes, making not the least resistance nor any attempt to evade the onslaught.

When she desists, he rises and sidles up to her, arching his neck and looking very pretty and graceful in his efforts to ingratiate himself. Then perhaps both have some sort of argument, facing one another, their heads stretched upwards

and rocking from side to side as they appear to discuss the matter in raucous tones. Gradually they become calmer, until finally the matter is settled and they have pledged their faith for the rest of the season.

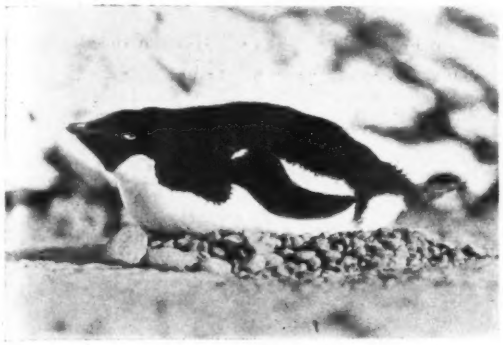


FIG. 2.—An adélie penguin sitting on eggs.

Once made the compact is final, and though unhappily, death from misadventure breaks up many a home, those that survive remain unswervingly faithful to one another. Overtures are frequently made by unmated cocks to mated hens during the early part of the year, before the eggs have come, but the husband takes good care of his wife, and soon drives off the interloper.

The pair being wedded, the cock fetches stones for the nest, which the hen builds. A week or so elapses and the first egg is laid. In two or three days' time the second appears. Up to this time none of the birds attempt to get food, but when the eggs are both laid one of the pair goes off to the nearest open water, and may remain away a week or ten days, after which it returns and takes its turn on the eggs (Fig. 2), whilst the other goes off for a similar period to catch the little shrimp-like crustacea that abound in the Antarctic seas, and to gambol with groups of neighbours in the water and on the sea ice.

The eggs take about thirty-two days to incubate, and at the end of this time the little plush-coated chicks appear all over the rookery. These grow at a great rate, eating voraciously. Some idea of their rapid growth may be got from the photograph showing a chick twelve days old (Fig. 3).

Now the adult birds are extremely fond of playing games, and spend whole days in playfully skirmishing with one another on the sea-ice near the rookery, and having rides on the ice floes that drift past on the tide. Consequently, the needs of the youngsters becoming greater as they grow bigger, when these are about a fortnight old an ingenious social arrangement is made by the entire rookery, resulting in a great economy of labour. Hitherto, the greatest care has been taken by the parents to prevent the chicks from straying away from the nests, because when they do so they are invariably pounced upon by the skua gulls which are always in attendance to prey upon them, and should the chicks seek the protection of neighbours the latter would only drive them away with savage pecks which might prove mortal to the tender youngsters.

Now, however, by mutual consent all this is changed, and the occupants of large groups of nests (Fig. 4) pool their chicks so as to form *crêches*, sometimes consisting of many dozens of youngsters, which are guarded by a few old birds who take turns to remain on duty whilst the rest are free to go off to get food and to play. The sentry birds take good care of the *crêches* under their charge, and soon drive in any of the chicks that try to get away, so that these learn to keep in a cluster and are safe from the attacks of the skuas.

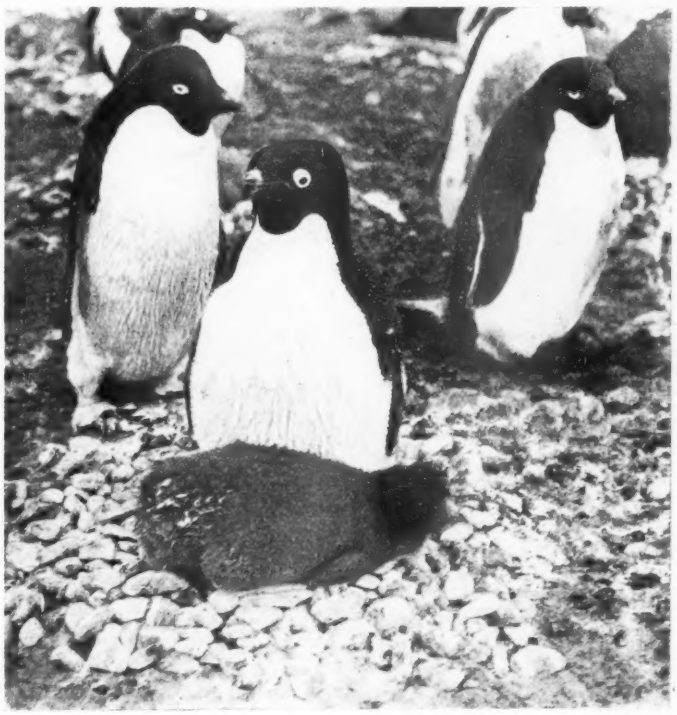


FIG. 3.—A chick twelve days old.

Surely this is a most wonderful development of social instinct on the part of a colony of birds.

When the chicks have changed their downy coats for a covering of feathers, it is time for both young and old to depart. The sun will soon be gone, the sea be frozen over, and the long Antarctic night begun. So the youngsters make their way to the water's edge, and here they learn to swim and to catch their own food. Some take to the water at once; others are more tardy, and these are encouraged to enter the new element by the old birds, who take pains to show them that they are as safe here as on land. Then in bands of some dozens at a time, the whole rookery takes to the sea and departs for the north, where the floating pack ice of the Antarctic seas affords them a safe home and the proximity of open water from which they must derive their food.

G. MURRAY LEVICK.

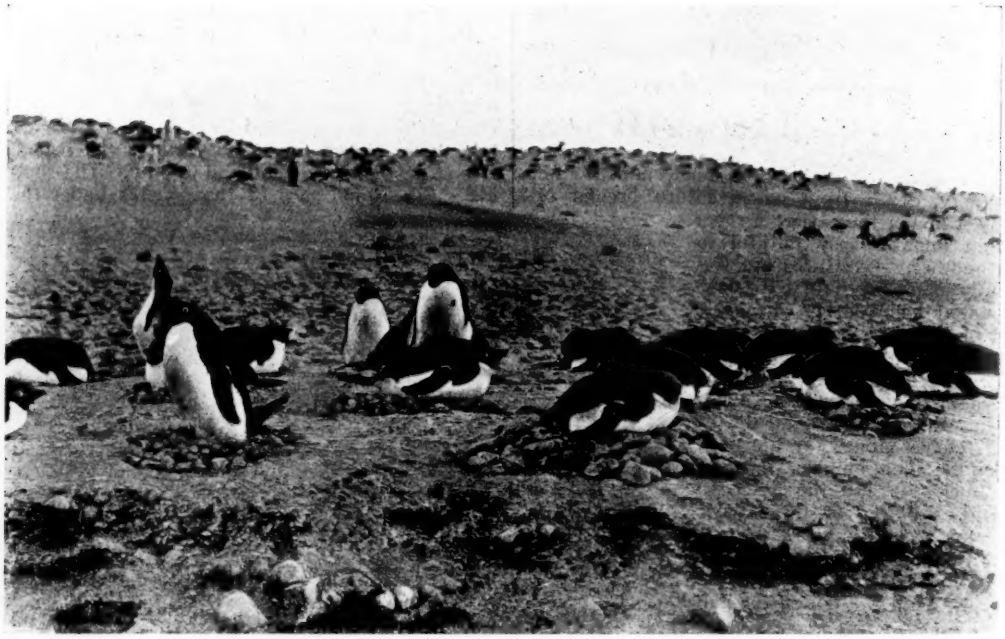


FIG. 4.—A group of nests.

RECENT PROGRESS IN AERONAUTICAL SCIENCE.

TWO lectures delivered recently have directed attention to striking progress in the development of aeronautical science. Simultaneously with these lectures, the "Wilbur Wright" lecture by Dr. R. T. Glazebrook, and the "James Forrest" lecture by Mr. F. W. Lanchester, results are published of experiments on an inherently stable aeroplane, the RE 1, constructed at the Royal Aircraft Factory. The two lectures and the flying machine are not wholly unconnected with each other.

Stable aeroplanes have been built before; Lieut. Dunne, Mr. Handley Page, and others, have produced aeroplanes which are inherently stable, and yet the RE 1, from a theoretical point of view, has an importance of a different character from its predecessors. If the older machines be examined they will be found to possess marked peculiarities in their wing construction, and in some cases have been clearly produced as the result of the study of natural wing forms. In all cases, however, the design is primarily based on the requirements for stability, and the strength of construction is a matter for important but secondary consideration.

On the other hand, as was remarked in a recent number of one of the technical flight periodicals, the absence of special stability features in the RE 1 is striking. Superficially, the aeroplane differs little from standard biplanes designed chiefly for strength and efficiency, and the procedure followed in its production was a complete reversal of that leading to the older stable machines. It is shown clearly that neither ease nor strength of construction nor efficiency need be sacrificed in order to obtain a stable aeroplane.

Like many other achievements, the RE 1 is not the sole production of any one person. The credit for some of the earlier links in the chain must go to those early mathematicians—Lagrange, Kelvin, Routh, etc.—who put the theory of the small oscillations about a state of steady motion on to a sound and regular footing. Later, the method has been applied to the particular problem of the aeroplane by Prof. Bryan, whilst, at the same

time, Mr. Lanchester, working from first principles, developed the same conditions for the production of longitudinal stability. Both investigations are dependent for numerical data on the results of experimental research on models, and in producing this the aerodynamical laboratories are concerned. In England such data are produced at the National Physical Laboratory, whilst France, Germany, Italy, and Russia have each one or more institutions for the purpose of aeronautical experiment.

Finally, there are the constructors and pilots who apply the results to practice. In the case of the RE 1 the application was made by the Royal Aircraft Factory, the pilot being responsible, not only for the flying of the machine, but also for the adjustments necessary to produce the desired amount of stability.

The mathematical analysis, most clearly expressed in Prof. Bryan's work on "Stability in Aviation," has shown that for all aeroplanes the motion may be considered as dependent on four surfaces. The surfaces need not have any exact material existence in the aeroplane but are equivalent to the sum of the effects of all the separate parts. The position of these surfaces can be described quite shortly; the largest of them carries practically the whole weight of the aeroplane, and in a monoplane is almost identical with the main planes. A second surface roughly parallel to the supporting surface and behind it is used to obtain longitudinal stability, whilst two vertical surfaces, one above and the other behind the main supporting surface, are necessary to produce lateral stability. The equivalent surface above the main planes is usually produced by turning up the wings near the body so as to make a dihedral angle, whilst that behind the main planes is in large part provided by the rudder and fixed tail fin.

Each of these equivalent surfaces is somewhat complex in character, and in particular the rear vertical fin is dependent on whether the propeller is running or stationary. Theoretical considerations indicate that any good flying machine can, however, be made stable by suitable choice of these four equivalent surfaces without affecting appreciably the design of the aeroplane from the point of view of efficiency and strength. Actual flight has shown how in one particular case, at least, it has been done.

The problem of flight, however, is more difficult than that of producing stability, and further analysis brings into prominence the importance of knowing the amount of stability. In the course of the Wilbur Wright memorial lecture, Dr. Glazebrook exhibited diagrams which, amongst other things, showed the amount of the rise and fall of a stable aeroplane in a moderate wind, this rise and fall being necessary for recovery from disturbance. As a deduction from these diagrams it appears that in really rough weather a stable aeroplane might be tossed about to an uncomfortable extent. The analysis which leads to this result also indicates a remedy, and by an extension it is possible to investigate the effect of moving the controls of an aeroplane and so to utilise the result as to produce a mechanical device for reducing the tossing. It is perhaps unwise to attempt to prophesy, but it appears to be probable that the aeroplane of the future will be inherently stable, with a degree of stability now thought undesirable, and that it will be provided with a mechanical device for operating the controls so as to reduce the effect of an external disturbance. Near the ground the pilot will always need to take control, for then the manœuvres may require to be quite different from those natural to the flying machine.

Problems of an urgent but entirely different character are also presenting themselves to the constructor for solution. A suitable engine is still being sought for, whilst the problem of safe alighting is probably the one now presenting the greatest number of difficulties.

TECHNICAL EDUCATION FOR FISHERMEN.

WE noticed, a short time ago (May 28, p. 324), the report of the Departmental Committee on Inshore Fisheries, but did not deal fully with the sections relating to education. Some of the recommendations made in the Report are most useful in so far as they direct public attention to the question of the better education of fishermen. We feel, however, that they do not suggest any useful advance upon what is already being done by certain local authorities under the stimulus of the Board of Education; and it is evident that the committee, in their desire to report speedily upon the other more important questions referred to them, did not fully acquaint themselves with the real conditions at the fishing ports so far as the instruction of fishermen is concerned.

Two distinct questions are involved: (1) that of the better education of the deep-sea men, and (2) that of the education of the inshore men.

(1) *The Deep-sea Fishermen.*—Until a few years ago it seemed as if the craft of the fisherman were almost the only one for which technical instruction was unnecessary. For centuries the methods of trawling, drifting, and lining have been carried on with essentially no modification. But with the development of the modern deep-sea fishing vessel, and the enormous industrial change which has followed this, there arose the necessity for a real knowledge of working methods of navigation. Even for such vessels working in the shallow seas a sound acquaintance with the rule of the road was necessary; and when steam-trawling became extended to Icelandic waters, the Barentz Sea, and the coast of Morocco, it became evident that there was little in the way of a knowledge of navigation, as it is practised aboard a transatlantic liner, that was not also required by the master of a steam-fishing vessel. Repeated and lamentable losses of life and property, experienced even during the last few months, have driven home this truth in the minds both of owners of fishing vessels and of

Board of Trade officials, so that the standard of proficiency expected from candidates for fishing certificates is now rapidly approximating towards that expected from foreign-going merchant service officers. This is as it should be, and under the stimulus of the increasing stringency of the Board of Trade examinations, and the active oversight of the Board of Education, fishery navigation schools are successfully being worked at Fleetwood and Piel, Grimsby, Hull, and other places. So much for the purely professional training of the fishermen, but with that desire to be "practical" which so appeals to the local administrators of public money, such handicrafts as seamanship, net-making and mending, engineering, knot-making, splicing, and cookery are also taught, with, we fear, indifferent success.

Nowhere in England, except at the Lancashire Sea-Fisheries Committee's Laboratory at Piel, Barrow-in-Furness, has marine biology and oceanography been taught. Usually instruction in those subjects has taken the form of public lectures given at the fishing ports, and no one who has had personal experience of this method of education can claim that it is even moderately successful. Systematised instruction in marine biology, so far as it relates to marine economic animals, was instituted in Lancashire in 1900, and has been continued in a gradually modified form ever since then. Personal laboratory work is done by the men, and the usual methods of instruction by means of lectures and demonstrations are also carried on in a very thoroughly equipped marine biological station. Scholarships are awarded by the county education committee to men who indicate their fitness for the instruction, and each fisherman student spends a fortnight at Piel, working from five and a half to nine hours a day for a fortnight. At the present time the instruction includes marine biology, seamanship, oceanography, and navigation. It is intensive and systematised, and has been successful to an extent indicated by the ease with which the men selected have obtained Board of Trade certificates; by the disappearance of the hostility with which the early attempts at fishery regulation were met; by the applications of scientific principles which have been made by the fishermen themselves in some localities; and by the ready cooperation of the men in the work of fishery investigation—in obtaining statistical data, for example.

Apart from such systematised instruction, deep-sea men can only educate themselves by infrequent, and mostly evening, attendance at the navigation schools, or at occasional fishery lectures. In itself this is an unsatisfactory method of instruction, and one which demands considerable expenditure of money, and of the very limited leisure time enjoyed ashore by these fishermen. But an equally serious difficulty is the defective elementary education of the men. At the present time a boy cannot go to sea in a deep-sea vessel until he is sixteen years of age, or unless he is apprenticed—a system of employment which is disappearing in most ports. He leaves school at fourteen, and the two years' interval is often spent in undesirable forms of shore employment, or in some form of inshore, or shore, fishing; and during this time what little primary education he did acquire mostly lapses. It is in these years, and during the first year or two of life at sea, that the education of fisher lads must be organised. It is not asking too much from the employers, during this period of a fisher-boy's life, that they should be made to send him to school on full or modified pay for, say, two or three months in the year to receive continuous and systematised instruction. It *is* asking too much from the lad, or from his parents, that he should either obtain his education by attending evening school after a long day's work, or by sacrificing a considerable fraction of his earnings. If the technical education of the fishermen is greatly to be improved this sacrifice should be expected from the employers of lads.

(2) *The Inshore Fishermen.*—It will probably be found impossible in actual practice to set up different systems of technical education for lads likely to become inshore or offshore fishermen. To begin with, it is clear that what a boy will become when he attains the age of sixteen depends on "chance," on temperament, or on opportunity. Some knowledge of the conditions on part of our coast convinces us that it is generally the lad who becomes "shiftless," either from temperament or example, or he who is naturally impatient of discipline or routine, or he whose parents desire to make the most of him regardless of his future, that swells the numbers of inshore fishermen, mussellers, cocklers, shrimpers, etc. It is all work that a strong boy, brought up by the seaside, can do almost as well as a man; work at which he can earn much more than he could at a skilled trade or in deep-sea boats—generally where a superior technique is required. A lad of this class who is ambitious and has received a tolerably good primary education will go to sea, not as an inshore fisherman, but either as a deep-sea fisherman, or in the merchant service. So far, then, as a primary education for a seaboard population can be specialised it should become one which includes simple science—marine biology and oceanography—if these matters can be taught at primary schools without prejudice to a plain elementary education without imperfectly taught fads.

The organisation of the continuation education—that which we suggest should be given, not in evening classes, but continuously as a fisher-lad's daily work throughout some part of the year—presents the greatest difficulty. There is no difficulty with respect to what ought to be taught the lad who is going to sea in deep-sea fishing vessels: what he must learn is still the "three R's," and such things as nautical astronomy, trigonometry, marine architecture, and magnetism. But are we really going to help our inshore fishing population by attempting to teach the boys "ropework, sail-mending, signalling,

carpentry, and metalwork," "practical courses on marine motors and their installation, net-mending and the preservation and curing of fish," and "business methods" all in continuation evening classes? Surely these are not school subjects, but handicrafts, and surely the attempt to teach them in schools is merely overloading a primary education already burdened by sufficient imperfectly taught "subjects." If these things are to be really useful they must be acquired by a boy in the daily practice of his occupation.

If scientific instruction can be given in addition to the above, so much the better, say the inshore committee. It is proposed that this instruction be given by "occasional lectures." These would explain "the most up-to-date methods as well as the cogency of the case for any newly imposed by-laws." They would "obviate any resentment felt for ordinances" and "convince fishermen of their expediency." Would they? The experience of the Lancashire local committee, which first in England attempted to regulate, by restrictions, a large inshore fishing population was that any attempt to argue for (or explain) by-laws by means of public lecture was fatal at once. But simply to impart, by means of sound laboratory instruction, the main things in the life-histories of marine economic animals—that is, by pure scientific instruction—has gradually effaced the intense hostility to legislative interference which those who began fishery regulation in England experienced. This end has to be attained *indirectly*. It is like the much-discussed question of sex-hygiene instruction. Why not plainly teach human physiology? And must one still apologise in England when he wishes to impart a scientific education?

Certainly methods of preservation, curing, marketing, etc., ought to be described in lectures and informal conferences; certainly methods of fishing in use abroad or in other parts of the country should be demonstrated; certainly the choice and upkeep of motor installations should be the subject of informal meetings and conversations, all these things being described to inshore fishermen by "practical" men or tradespeople. But this is rather organising the industry than educating the fishermen. J. J.

SECULAR CLIMATIC CHANGES IN AMERICA.[1]

NEITHER the meteorologist nor the geologist commonly realises the extent and importance of the changes which have taken place during the "historic period." The latter is apt to close his investigations with the Ice Age; the former too often concerns himself only with the period of instrumental observations. The intervening "post-Glacial" time is the field of relatively few workers, who are rapidly building up the new science of "Palæoclimatology."

Prof. Huntington's elaborate memoir on the "Climatic Factor" should do much to gain recognition for at least the later stages of this period. From the viewpoint of the "pulsation" theory of climates developed during similar investigations in arid Asia, the author studies the climates and their attendant effects during the last thirty-five centuries over an area extending from California to Guatemala. A study of the ruins of arid New Mexico shows that at three distinct periods prior to the coming of the Spaniards the country was able to support a far greater population than can exist at present; this could only have been possible with a heavier rainfall, permitting the cultivation of regions now too dry for agriculture. The strand lines and gypsum dunes of the Otero Soda Lake and the alluvial terraces of the rivers point to the same conclusion (though the theory that even in rivers reaching the sea terraces and deltas are the result of changes of climate rather than of level will come as a shock to most English geologists).

In America there are no continuous historical records from which the ruins can be dated; this deficiency is supplied in an unexpected way by the measurement of the rings of growth of the giant Sequoias of California, some of which are more than three thousand years old. By means of an empirical formula, Prof. Douglass, in a chapter on a method of estimating rainfall by the growth of trees, has been able to reconstruct the rainfall, for the period over which records exist, with an accuracy of 82 per cent. With the very old trees, however, a number of corrections are necessary, which render uncertain the slope of the curve plotted from the measurements, although they do not impair the evidence of short-period fluctuations. The corrected curve shows cycles of 155 years, of 21·0 years, and of 11·4 years, and in addition three long wet periods, from 1000 B.C. to 300 A.D., from 900 to 1100 A.D., and from 1300 to 1400 A.D., which Prof. Huntington considers must correspond to the three native civilisations of New Mexico.

This curve is next compared with the curve previously published in "Palestine and its Transformations," showing the fluctuations of climate in arid Asia. There is a pronounced agreement between the two curves, especially during the period from 300 to 1000 A.D.

The Maya civilisations of Yucatan and Central America are next investigated—though, since these regions largely suffer from an excess of precipitation, they can scarcely be included in "*arid*" America—and the theory is developed that these extinct civilisations fell in dry, cool periods contemporaneous with the moist periods of New Mexico, both changes being the result of a southward movement of the subtropical anticyclone. The coolness stimulated the Mayan races into activity, and the dryness enabled them to master the forest. The dates of the Maya chronology are not yet satisfactorily worked out, but so far as they go they confirm this correlation. An attempt is made to connect the terrestrial changes with changes of the sun's surface, but the results, which are illustrated by curves, do not appear to

[1] "The Climatic Factor as Illustrated in Arid America." By Ellsworth Huntington, with contributions by Charles Schuchert, Andrew E. Douglass, and Charles J. Kullmer. Publication of the Carnegie Institution of Washington, No. 192. Pp. v+341. (1914.)

attain a high degree of definiteness. Discussions by C. J. Kullmer on the shift of the storm track, and by Charles Schuchert on climates of geologic time, complete the volume.

The memoir is written in Prof. Huntington's usual vigorous style, and is well illustrated with photographs, diagrams, and curves. In this connection it must be remarked that although the graphical method of comparison is very valuable, it would have been usefully supplemented in the case of the long series of comparable values by the calculation of correlation coefficients, which give a quantitative measure of the relationship. The vigorous American style, also, is apt to strike English ears harshly, as when on page 73 the author writes: "The present water supply . . . is almost negative, and the possibilities of agriculture still smaller." These, however, are very minor details, and in no way detract from the value of the memoir as a detailed comparative study of several lines of evidence bearing on a subject hitherto somewhat neglected.

NOTES.

THE London office of the British Association has learned from the officers of the Association in Australia that the overseas party has safely arrived, and that the meeting is proceeding in accordance with the original programme.

THE Meteorological Conference, which was to have taken place in Edinburgh in September, has had to be postponed. A further announcement respecting it will be made in due course.

THE International Seismological Congress, which was shortly to have been held at St. Petersburg, has been postponed.

IT was stated in our last issue (p. 590) that forms had been circulated by the British Association Committee for Radiotelegraphic Investigation for the use of those who will observe the forthcoming solar eclipse and who were prepared to make notes of "strays" and to record the measurement of the strength of signals, five high-power wireless telegraph stations in Europe having undertaken to make a series of special emissions during the eclipse. The outbreak of hostilities on the Continent will doubtless make it impossible for the programme of proposed emissions to be carried out, and intending recorders of the observations above referred to are therefore informed that the suggestions of the Committee cannot be carried into effect.

THE many friends of Prof. W. A. Bone will be distressed to learn of the death, on August 8, at a Leeds nursing home, of Mrs. Bone, which followed upon an operation. Prof. and Mrs. Bone with their family were on holiday at Burnsall, Wharfedale, when the necessity for the surgical operation referred to arose. Mrs. Bone took a deep interest in the progress of science, and subordinated all other considerations to the furtherance of her husband's scientific work. Prof. Bone will receive the respectful sympathy of his scientific friends, and past and present colleagues.

THE death is announced, in his eighty-third year, of Prof. F. Humphreys Storer, a distinguished American chemist. In 1853 he served as chemist to the U.S. North Pacific exploration expedition. After studying abroad, he spent several years in practising as a chemist at Boston. From 1865 to 1870 he was professor of general and industrial chemistry at the Massachusetts Institute of Technology, and from 1870 to 1907 he held the chair of agricultural chemistry at the Bussey Institution. He was the author of several text-books of chemistry, two of which were written in collaboration with Dr. C. W. Eliot, the ex-president of Harvard.

WE regret to notice the death, on Saturday last, at the age of forty-eight, of Sir Edward Anwyl, principal of the Monmouthshire Training College, and lately professor of Welsh and Comparative Philology at the University College of Wales, Aberystwyth.

IT is stated in the *Geographical Journal* that the Swedish Riksdag has voted to the Anglo-Swedish Antarctic Expedition the sum asked for, viz. 1500*l.* a year for five years, on condition that a similar amount is raised in England. Prof. O. Nodenskjöld will assume the leadership of the expedition for the first year and a half. The other members of the staff have not yet been chosen.

IT is stated in the *Morning Post* that in future the distribution of the Nobel prizes will take place on June 1 instead of in December, as hitherto. The next distribution has been fixed for June 1, 1915.

THE Earl of Londesborough and Mr. E. O. Sachs, of the British Fire Prevention Committee, have circulated a letter appealing for the names and addresses of qualified men prepared to enrol themselves as an emergency fire service force to be placed at the service of the Government for use in our fortified and defended places, our arsenals and national stores, and in certain Government establishments requiring special protection. Retired Fire Brigade officers and firemen —both professional, volunteer and private—and a limited number of Fire Brigade officers and firemen of inland (country) brigades, both volunteer and private, not exceeding three from any one brigade, are needed. It is also proposed to form a supplementary roll of young engineers (used to steam engines or motor-cars) and young surveyors or architects (used to building, survey, or dangerous structure works), who, although not having actual fire experience, would be valuable in an emergency fire service force. Applications for enrolment should be addressed to Lord Londesborough and Mr. Sachs at the offices of the British Fire Prevention Committee, 8 Waterloo Place, London, S.W.

THE current number of the *Geographical Journal* contains well-executed process plates of the memorial about to be erected to Captain Scott and the companions who perished with him in the Antarctic, and that of Dr. E. A. Wilson, which was unveiled at Cheltenham on July 8 by Sir Clements Markham. The design of the Scott memorial is the work of Mr. A. H. Hodge, and the general plan is as follows:—A granite pylon is surmounted by a bronze group representing

courage sustained by patriotism, spurning fear, despair, and death, the figure courage being crowned by immortality. The front of the pylon bears the names of the five men, and portrait medallions, in bronze, occupy prominent positions on the monument. On the back are represented a pair of snowshoes, a replica of the cross erected on Observation Hill, and a wreath. Beneath is given an extract from Capt. Scott's last message. On the four sides of the base are bronze relief panels depicting the course of the expedition, under the headings "to strive," "to seek," "to find," "and not to yield." The Wilson memorial was designed by Lady Scott. It is in bronze 7 feet high, on a base of Portland stone, and represents the explorer in Polar dress in a natural attitude.

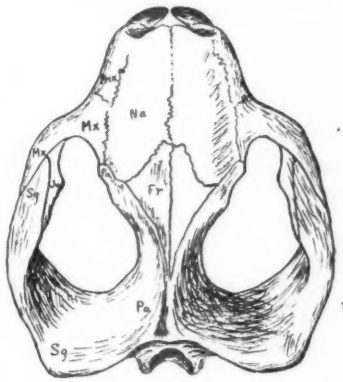
WE are asked to state that, in consequence of the war, the editorial duties in connection with the Gipsy Lore Society have been assumed, in collaboration, by the Rev. F. G. Ackerley, Grindleton Vicarage, near Clitheroe; Mr. E. O. Winstedt, Oxford; and Mr. A. Russell, Stromness. Members of the society are requested to address business communications to the first-named gentleman.

THE fifth report of the Royal Commission appointed to make an inventory of the ancient and historical monuments and constructions of Wales and Monmouthshire has just been issued. The inventories of Denbighshire are in the press, and will be issued in the course of the present year. The inspection of the monuments of Carmarthenshire has been completed, and the inventories are in preparation for the press. The volume on that county will be taken in hand immediately on the publication of that for Denbighshire. The inspection of the antiquities in the county of Merioneth is in progress, and will be concluded this year. Occasional reports are received of damage done to the monuments, as a rule to those of the prehistoric class, and, though the commission is powerless to exert active interference in such cases, endeavours are made to exert what influence is possessed by it in the best interests of the public.

THE July number of the *Journal of Anatomy and Physiology* contains three interesting embryological studies based on the construction of wax models. N. C. Rutherford points out certain resemblances between the fore-limb of the human embryo and that of the toothed whale and certain reptiles, suggestive of the fact that the history of the race is here repeated in the development of the individual. J. E. Frazer has investigated the development in the human embryo of the region of the internal and middle ear, while J. K. Milne Dickie has described the anatomy of the head end of a human embryo. The remaining articles are purely anatomical studies. Miss J. Meiklejohn gives an interesting series of illustrations demonstrating the position and relations of the groups of nerve cells in the heart of the rat. H. Blakeway's investigation on the anatomy of the palate is mainly of surgical interest, while that of D. E. Derry deals with a pathological perforation of the skull of an ancient Egyptian.

AN interesting feature in Captain S. S. Flower's report on the Giza Zoological Gardens for 1913 (included in the report on the Zoological Service for the same year, issued by the Ministry of Public Works, Egypt) is the reproduction of a photograph of a living Nubian ibex with the largest horns on record; the left horn measuring $51\frac{1}{2}$ and the right $50\frac{3}{4}$ inches, while the tip-to-tip interval is 35 inches. The enclosure of the two large paddocks for giraffes, together with the erection of the necessary buildings, has been completed, and the series of twenty-eight paddocks for antelopes were all but finished at the close of the year.

ALTHOUGH described by the late Prof. Cope so long ago as 1870, on the evidence of a fragmentary skull and teeth from the Puerco, or Lowest, Eocene of New Mexico, the genus Polymastodon, belonging to that group of early mammals known as the Multituberculata, has hitherto been very imperfectly known. A recent expedition dispatched by the American Museum to the Puerco beds of New Mexico was, however, fortunate enough to discover a number of remains of the genus, among these being a skull which, although much crushed and broken, was found to be capable of restoration. This unique specimen is described and figured in vol. xxxiii (pp. 115–134) of the Bull. Amer. Mus. Nat. Hist. by Dr. R. Broom, whose figure is here reproduced. In the general characters of its dentition and its relative shortness and breadth, the skull, which measures about 6 in. in length, distantly recalls that of a rodent; the dental formula being



Skull of *Polymastodon taoensis*. *Fr*, frontal; *Ju*, jugal; *Mx*, maxilla; *Pa*, parietal; *Pmx*, premaxilla; *Sq*, squamosal.

$$i.\frac{2}{1}, c.\frac{0}{0}, p.+m.\frac{3}{3}.$$

Among its many peculiarities are the cutting-off, by means of processes of the parietals and nasals, of the frontals from the orbits, and the apparent absence of lachrymals. As regards the affinities of the multituberculates, Dr. Broom (in opposition to the opinion of Dr. Gidley, who, as recorded in NATURE in 1909, definitely included them in the marsupials) considers that these are with the monotremes (duck-billed platypus and echidna), a remarkable feature being that the Tertiary Polymastodon comes nearer to that group than does the South African Triassic Tritylodon. On the whole, it seems probable that mammals originated during the Trias from cynodont reptiles, and that from this original stock diverged at an early date a branch which gave rise to the multituberculates, and later, after considerable specialisation and degeneration, to monotremes.

AN elaborate study of the auditory ossicles of American rodents has been made by Messrs. Cockerell, L. Miller, and M. Printz, in the hope that it might elucidate the taxonomy and origin of the order they represent. The work, which is published as article 28 of vol. xxxiii. of the Bulletin of the U.S. National Museum, has not, however, led to any very decisive result with regard to either point, Dr. W. D. Matthew remarking in an appendix that the frequent occurrence of parallelism and convergence is likely to be a bar to the taxonomic value of these structures. In reference to the suggestion that rodents are derived from the multituberculates, the same palæontologist, in a footnote, states that is an altogether untenable theory.

THE *Daily Malta Chronicle* of July 22 records the stranding at Birzebbugia on July 20 of a "sea-monster." It measured 16½ ft. in length, was black in colour, and armed with eighteen pairs of teeth. Although referred to as a "cachelat," it was probably a blackfish (*Globicephala melaena*).

THE August number of the *Selborne Magazine* contains that portion of the annual report of the Selborne Society for 1913, which deals with the natural history of the year. In the section on the protection of animals, it is recorded that the hawfinch nested—so far as known for the first time—in the Brent Valley bird-sanctuary.

THE July number of the *Museums Journal* contains a photograph of the model of the skeleton of the early Tertiary Egyptian ungulate, *Arsinoëtherium zitteli*, to which attention was directed in our columns a few weeks ago. The Children's Museum at Olympia, which has been so admirably arranged, under conditions not altogether the most suitable, by Mr. W. Mark Webb, and the Wilton Park Museum, Batley, Yorks, form the subject of other articles in the same issue. The Wilton Park Museum does not restrict its scope to local subjects, one room being devoted to illustrations of life in Biblical lands.

IN an appendix to a reprint of an article in the May number of *Zoologica*, it is stated that three of the school of bottle-nosed dolphins, or porpoises, in the New York Aquarium (to which reference has been already made in NATURE) died early in June from tubercular pneumonia, and that the rest were suffering from ulceration of the skin, due to the low degree of saltness in the water of their pond.

IN the February issue of Section D of the *Philippine Journal of Science* (vol. ix., No. 1) Mr. D. C. Worcester records the occurrence off the coast of Palawan of what is definitely asserted to be a flying crustacean. The creature was seen thrice by Mr. Worcester, and once by Mr. Schultze, and on this evidence, despite the fact that no capture was made, it is asserted that "there remains no doubt of the existence in the Philippines of a marine crustacean, from 15 to 25 centimetres in length, which has the power of rising rapidly from the water and flying, after the fashion of a flying-fish, for several rods." Articles by A. Seale on the preservation of food-fishes and other commercial fishery products in the tropics and on the fishes of Hong Kong, and a third, by Mr. Artemus Day, on the osteology of the Philippine "slime-head" (*Ophiocephalus striatus*), a fresh-water fish, are included in the same issue.

IN the April number of the *Ann. Mag. Nat. Hist.* (8), vol. xiii., 1914, pp. 380–9, Prof. Chas. Chilton records the presence of the well-known wood-boring "gribble" (*Limnoria lignorum*) in Auckland Harbour, New Zealand. He believes that this isopod must been introduced into Antipodean waters many years ago in the timbers of some old wooden ship. In connection with this record, Prof. Chilton discusses the relationships of the six known species of Limnoria which are all closely related to each other, and describes in some detail *L. segnis*, a form indigenous in New Zealand seas, which does not bore into timber, but lives in seaweed. He regards the wood-boring habit as normal for the whole genus, and explains the wide distribution of the species as due to transport by floating logs. In a supplementary note he points out that Dr. W. M. Tattersall, in his account of some of the Crustacea of the *Scotia* expedition, records *L. lignorum* from the Falkland Islands. There is, however, a characteristic *L. antarctica*—a seaweed-borer like *L. segnis*—which lives off South Georgia, the South Orkneys, and the South Shetlands. It may be that these far southern members of the genus show, rather than our European "gribble," the primitive habit of the group.

THE Clare Island Survey carried out by the Royal Irish Academy has published two further volumes: a full report on Archiannelida and Polychaeta, by R. Southern; and a paper on Tree-Growth, by A. C. Forbes. The latter reaches the conclusion that the absence of such trees as the ash, alder, and wych elm from the whole of the western islands suggests that these islands possess only the oldest representatives of the Irish forest flora, and were separated from the mainland at an early period. Pine and birch were the principal species at first, but oak and hazel followed, and gradually dominated the pine. The present treeless condition of the island is largely due to human agency, but there is reason to believe that the summers are cooler than when the oak was largely represented.

MISS LILLIAN S. GIBBS has contributed to the Journal of the Linnean Society (Bot., vol. xlii.) an extensive and valuable description of the flora and the plant associations of Mount Kinabulu and the highlands of British North Borneo. Although the coastal flora of the country had been well explored previously, the author has been able to add to the already known flora of Mount Kinabulu itself 129 new records; in all she collected about a thousand species, of which eighty-seven have proved new to science, including four new genera, while 337 species (comprising three new genera and thirty-eight new species) are referable to the mountain itself. The systematic account, which contains valuable notes on many of the species, is preceded by a detailed general description of the ecology and plant-geography of the area which the author has so strongly explored.

DR. N. O. HOLST supports Jamieson's theory of the subsidence of large areas under the weight of the ice-sheets of the Glacial epoch ("Le commencement et la fin de la période Glaciaire," *L'Anthropologie*, vol. xxiv., p. 353), and urges that glacial conditions are primarily due to elevation of the land. Such elevation defeats itself, as it were, since the spread of the ice soon causes a depression. The upward swing, after melting has occurred, may promote a further, but less important, glaciation, and when, on depression, this second series of ice-sheets melts, the Glacial epoch comes to an end. It must be remarked that the real difficulty of the isostatic theory of movements during an ice-age lies in the impossibility of saying how far these were complicated by crust-displacements of a more normal order.

DR. J. V. HANN, in an article in the *Oesterreichisches Bäderbuch* on climatic factors from the balneological point of view, points out that existing statistics for health resorts only partially meet the requirements of medical men as regards information wanted for invalids. The subject is discussed under each element at considerable length, and the author's great authority in climatological matters lends additional weight to his views. We can only very briefly refer to a few of the points. *Air temperature*: the hours usually adopted require to be supplemented in some cases, and the mean dates given of the occurrence of certain temperatures in spring and autumn. The desirability of publishing "variability" of temperature (the difference of the mean from one day to the next), and possibly for different parts of the day is urged. *Wind*: references are made to experiments on the cooling effect of different wind forces, and to a useful instrument (homöotherm) lately devised for the purpose of determining the loss of heat due to wind. *Humidity*: Dr. v. Hann thinks that "relative humidity" is most suitable from a biological point of view; the readings of the wet-bulb thermometer (in conjunction with those of the dry-bulb) are also important. *Sunshine*: Mean duration is best shown by the ratio to the possible amount. Of other methods, that giving the mean daily duration is more convenient than that showing the total number of hours. *Fog*: the mean data as mostly published are misleading; the time of its occurrence is wanted. The second part of the article contains a general sketch on the climatic districts of Austria.

A RECENT publication of the Meteorological Office, "Hourly Values from Autographic Records, Geophysical Section, 1912," includes data meteorological, magnetic, and electrical. The meteorological data consist mainly of normal hourly values for each month of the year of barometric pressure, temperature, relative humidity, wind velocity, rainfall, and duration of bright sunshine at Aberdeen, Falmouth, Kew, and Valencia, and the differences from these normals observed in 1912. For Eskdalemuir, a recent station, the information is confined to 1912. At the end of the volume there are some notes by Mr. E. Gold on the principal meteorological phenomena, and some tables explanatory of the units (millibars, absolute temperatures, etc.) employed. The magnetic part gives hourly values of the north and west magnetic components at Eskdalemuir. The vertical force magnetograph, it is explained, did not give trustworthy results. There are also tables of diurnal inequalities from all days at Eskdalemuir, and from five "quiet" days a month at Kew and Falmouth. Other tables give inequality ranges, non-cyclic changes, Fourier coefficients for the diurnal variation and mean annual values of the magnetic elements. The electrical material bulks much less largely. It consists of mean monthly values and diurnal inequalities of potential gradient at Kew and Eskdalemuir. There are explanatory remarks and comments by the superintendents of Kew, Eskdalemuir, Falmouth, and Valencia Observatories, and a preface by the director of the Meteorological Office.

"THE Seaman's Handbook of Meteorology," recently issued by the Meteorological Committee as a companion to the "Barometer Manual for the Use of Seamen," is, in fact, a general meteorological treatise covering to some extent the same ground as the "Observers' Handbook" (which is published annually for the use of observers at land stations), with the addition of special chapters on "Seamen's Weather," relating especially to wind, fog, and floating ice. It is intended to replace the "Fishery Barometer Manual" which has been issued for many years for use in connection with barometers lent to fishery stations and small seaports. The work has been carried out in a very satisfactory manner by Commander Campbell Hepworth, marine superintendent of the office. Full explanations, based on investigations of scientific men generally, and on Meteorological Office publications, are given, with frequent extracts, of the processes at work in the production of meteorological conditions. These are illustrated by excellent pictures of clouds, and by typical synoptic charts of high and low barometric pressure, some of which are supplemented since the time of original issue by data from wireless telegrams, so that the area westward has been much extended. The chapter on icebergs and other forms of drifting ice, not usually found in ordinary text-books, will be much appreciated by meteorologists generally. The handbook is accompanied by an instructive prefatory chapter by Dr. W. N. Shaw, on the old and modern aspects of maritime meteorology.

THE Proceedings of the British Academy, vol. vi., contains an interesting article by Prof. Silvanus P. Thompson, on the "rose" of the winds and the origin and development of the compass card, which was read in April, 1913, at the International Historical Congress. It deals with the origin of the names of the winds, the letters denoting which appear on many of the older compass cards, also with the origin of the arrangement of the "rose" of 32 points, and with the distinctive marks on compass cards. A curious fact related by Prof. Thompson is that the fleur-de-lis, now in general use to denote the north, did not appear on compass cards prior to 1500. He thinks there is something to be said for the view recently advanced by Herr Schück that the device was originally intended to represent the primitive form of floating compass in which a lance-shaped needle was supported between

two wooden floats. After a general review of the development of the compass card, Prof. Thompson gives a classification of the principal forms which appeared prior to 1600. Beautifully coloured illustrations appear in five of the six plates at the end of the paper. From an artistic point of view it is to be regretted that, as has been the case with ordinary male attire, colour has now disappeared from compass cards. At first almost universal, it seems to have died out before the end of the seventeenth century.

IN the *Quarterly Review* for July, Mr. George Forbes, in a review of Sir David Gill's "History and Description of the Royal Observatory, Cape of Good Hope," gives a sympathetical account of the life and labours of "this great man, who will live in the hearts of all who knew him, not only as among the greatest of astronomers, but also as one of the noblest and most lovable of men." Special attention is naturally given to his work at Capetown between 1879 and 1907. The comments on his career by the most eminent astronomers of the day, included in this article, show the great scientific value of his work, and the impression left on his contemporaries by his unselfish devotion to science and by the nobility of his character.

BULLETIN No. 11 of the Indian Association for the Cultivation of Science consists of three papers by Mr. C. V. Raman on the dynamics of vibration, which are well illustrated, and cover fifty-two pages. The first deals theoretically and experimentally with the vibrations of a silk thread attached at its two ends to the prongs of two tuning-forks of different periods the directions of motion of which are parallel to the string. If M and N are the frequencies of the forks, it is shown that the string will be set into vigorous transverse oscillation if the tension of the string is so adjusted that the natural period is nearly $\frac{1}{2}(Mm \pm Nn)$, where m and n are integers. The second deals in the same complete manner with the possible frequencies of oscillation or speeds of synchronous rotation of a soft iron wheel with thirty teeth mounted between the two poles of a small electromagnet fed by an alternating current of frequency 24 or 60 per second. The third describes new methods of studying the relation between the motion of the bow and that of the bowed point of the string it sets in motion, and of recording the motion of each point of the string. It appears from the author's observations that in all cases in which the displacement time curve of the bowed point is saw-toothed, the velocity of forward motion of the bowed point is identical with that of the bow.

THE Government have taken over two battleships, one completed and the other shortly due for completion, which had been ordered in this country by the Turkish Government, also two destroyer leaders ordered by the Government of Chili. Reference is made to the battleship *Sultan Osman I.*, now H.M.S. *Agincourt*, in the paper read at the joint meeting of Naval Architects at Newcastle by Mr. J. R. Perrett, chief of the shipbuilding department at Elswick, where the ship was built. The vessel is 632 ft. long, with a beam of 89 ft. and a displacement of 27,500 tons. She carries fourteen 12-in. guns, twenty 6-in. guns, and a number of small guns. Her main armour belt is 9 in., and the upper belt 6 in. She has various armoured decks and extensive magazine protection. She is designed for a speed of 22 knots.

MESSRS. LONGMANS AND CO. have in preparation "The Year Book of Radiology for 1915." It is to be edited by Dr. R. Knox and J. H. Gardiner, and its object is to give an account of the more recent advances in our knowledge of radium, X-rays, and the allied phenomena, both from the medical and physical point of view. The volume will comprise a series of authoritative articles by specialists working in radiology, and a directory of qualified medical men practising in radiography, X-rays, radium and electro-therapeutics, both at home and abroad, also a list of hospitals and institutions where such treatment is carried out.

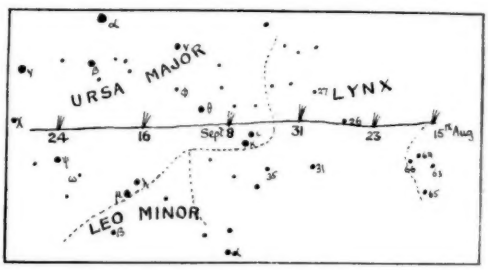
OUR ASTRONOMICAL COLUMN.

COMET 1913*f* (DELAVAN).—The following ephemeris and chart give the positions of Delavan's comet for the remainder of the present month and September. This ephemeris is given by Dr. Crommelin in the July and August numbers of *Knowledge*:—

Greenwich, Midnight.

		R.A. h. m. s.	Dec. ° ′
Aug. 15	... ...	6 54 24	... +43 44
23	... ...	7 31 14	... 46 22
31	... ...	8 15 43	... 48 35
Sept. 8	... ...	9 8 35	... 49 56
16	... ...	10 8 6	... 49 51
24	... ...	11 9 33	... +47 56

During the present month the comet is travelling in the constellation of the Lynx, passing



then into Ursa Major. The best time for observation is the early hours of the morning, and Dr. Crommelin thinks "that the prospects are hopeful for this comet being an interesting spectacle in September and October. There is already no doubt that it will be visible to the naked eye."

THE PERSEIDS.—The progress of this shower up to and including August 10 was watched by Mr. Denning at Bristol, and he reports it as fairly active, though on August 10 the number seen was decidedly scanty.

The shower first gave intimation of its oncoming on July 14, and there has been a gradual increase since that date. On August 10 the radiant point was very exactly defined at 43°+56°. On nights when the position could be determined from a sufficient number of meteors it showed the usual displacement.

On July 27, at 10h. 58½m., a fine meteor, brighter than first magnitude, was doubly observed by Miss Cook at Stowmarket and by Mr. Denning at Bristol. Its heights were from 85 to 56 miles from over Hailsham to Selsey Bill on the south coast. Its path extended over 49 miles at very swift speed.

On August 7, at 10h. 37m., a brilliant Perseid, giving a vivid flash and leaving a streak for ten seconds, was seen at Bristol. It shot from 286½°−2½° to 280°−13½°, but no further observations of this fine object have yet been received. On the same night, at 10h. 10m. to 10h. 15m., a "mock moon," or Paraselene, was observed at the same altitude as the moon, and about 23° east of our satellite.

This year, moonlight has interfered with the character of the Perseid display in its earlier stages, but her lustre will not materially obscure the meteors at the period of their expected greatest frequency, on August 11 and 12, when a considerable number of observers will have been engaged in watching them if the weather was suitable.

A NEW SATELLITE TO JUPITER?—In the *Times* of August 8, it is stated that "a telegram has been received announcing the discovery of a tiny object near Jupiter, which appears to be a new satellite of the planet. The discovery was made photographically by Mr. Nicholson at the Lick Observatory, Mount Hamilton, California. He reports that the new body is still fainter than the eighth satellite, which is of the seventieth magnitude, and only about forty miles in diameter, so that it can only be observed with very large instruments." It is further stated that on July 21 the new body was 6m. 41s. west of Jupiter, and on July 24, 6m. 36s. W.

STELLAR RADIAL-VELOCITY OBSERVATIONS.—In 1908 Prof. Küstner published the results of the radial velocities of ninety-nine stars of the spectral types F to M, which he determined during the period 1903 to 1908 with the three-prism spectrograph of the 30 cm. Bonn refractor. The faintest star then photographed in two hours was of the magnitude 5·2. In *Astronomische Nachrichten*, No. 4750, he publishes the radial velocities of 227 stars of the spectral type F to M which he has determined during the period 1908 to 1913, with the same refractor. In this case a new spectrograph was employed in order to continue the work to fainter stars. At the conclusion of the individual observations he compares his values, where possible, with those obtained by Prof. Campbell at the Lick Observatory: the values for 151 stars are available, and he determines the mean differences of the observed radial velocities, Lick minus Bonn, for each spectral class. These differences he regards as errors of the Bonn observations, taking into account the better observing conditions and more efficient instruments available at the Lick Observatory. Mr. J. H. Moore publishes in the Lick Observatory Bulletin, No. 257, the observations of seventeen stars the radial velocities of which vary, and also those of two stars which have large and apparent constant radial velocities. These stars are AGC 7195 and ω Pavonis of magnitudes 5·2 and 5·1 respectively. They belong to the spectral classes G and K, and the velocities derived were +184·8 and +184·4 kilometres a second respectively.

THE SOLAR ECLIPSE.—The *Times* announces that a telegram has been received from Major E. H. Hills, president of the Royal Astronomical Society, stating that he and Prof. A. Fowler, who had intended going to Kieff for the purpose of observing the solar eclipse, have abandoned their project, and are on their way to St. Petersburg.

SOUTH AFRICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE twelfth annual session of the South African Association for the Advancement of Science was held in Kimberley, Cape Province, during the week commencing Monday, July 6, under the presidency of Prof. R. Marloth. There was the usual round of festivities and of visits to places of scientific or historic interest. The association meets in four sections, but in view of the increasing interest of matters pertaining to South African native races, Section D resolved to establish a subsection for African ethnology, education, history, language, and native affairs before next year's meeting in Pretoria is held.

The papers read numbered between forty and fifty, and brief outlines of the four sectional presidential addresses and some of the papers contributed by members are given below.

Dr. A. Ogg, professor of physics at Rhodes University College, Grahamstown, in his presidential address to Section A, dealt with some of the ideas in physical science which are under discussion at the present time in the light of recent research, and sought to bring under review some of our fundamental notions or principles, having regard to the fact that what mathematicians and physicists have long considered well established is now being uprooted and replaced by non-Newtonian mechanics based on the principle of relativity. Shape and mass, in fact, are looked upon as functions of velocity. Scientific thought, Prof. Ogg described as so plastic nowadays that the most cherished tenets of the last generation of men of science are being abandoned, and the greatest danger is that the meaning of the involved consequences is not always realised. As to the true physical meaning of the new ideas propounded there is much speculation, and many hold such speculations to be beyond the true scope of science. Quoting Schuster, in conclusion, Prof. Ogg said that all preferred being right to being wrong, but it is better to be wrong than to be neither right nor wrong.

In Section B the presidential address was given by Prof. G. H. Stanley, of the Transvaal School of Mines and Technology, whose subject was "A Decade of Metallurgical Progress on the Witwatersrand." The greatest advances during the last ten years, he said, were in improving methods of carrying out the various stages of the extraction processes, the essentials remaining unchanged. Sorting tables, for example, had been replaced by travelling belts, which were also elevators. Amalgamation is now carried out by flowing the tube-mill product over stationary plates, shaking plates having been discarded. Slime is now being treated more cheaply than sand; classification had greatly improved, and this, together with finer grinding, ensured that the sand residue after cyaniding contained only 0·2 of a dwt. of gold per ton. For slime treatment filtering methods were now sometimes employed, giving higher gold extraction and increased profits. Working costs had been brought as low as 3*s.* per ton.

In Section C, comprising the biological sciences and agriculture, the presidential address of Prof. George Potts, of Grey University College, Bloemfontein, dealt with rural education. South Africa, except the Rand and some coast towns, Dr. Potts pointed out, is essentially rural, and inland towns depended on the surrounding pastoral population. All grades of education should therefore be made adaptable to a rural people. The following reforms were advised:—(1) More representation for agriculture and the natural sciences on the University Council; (2) encouragement of the study of natural science in university colleges; (3) appointment of additional school inspectors specially qualified

to deal with nature-study and science teaching; (4) more teaching of nature-study, school gardening, botany, and zoology at the training colleges; (5) a more liberal matriculation, allowing of two natural sciences alternatively to Latin and mathematics; (6) more biology in secondary schools; and (7) systematic and correlated nature-study and school gardening in the primary schools.

Prof. W. Ritchie, of the South African College, and Vice-Chancellor of the University of the Cape of Good Hope, presided over Section D, and in his inaugural address discussed "Some Aspects of Language Study." Comparing the science of language with the other branches of natural science, he showed the disadvantage of the former in that it lacks actual objects capable of being handled and experimented with. The spoken word perishes, and cannot be retained as a labelled specimen for investigation at leisure, so that the student of a thousand years hence, with no data regarding the English language save its written symbols, would be unable to reconstruct from these the exact vocal sounds which they represent for us. Fortunately specimens of vocal sounds may now be stored away for reference by means of the gramophone, and even the records now being produced for mere amusement may thus aid the objects of science. Some European countries already possess large collections of records showing distinctive features of various dialects, and it may be feasible with every census of population thus to provide for a census of language. In South Africa there is an amazingly wide field open for investigation; in English, with its varieties of local intonation; in Dutch with its three recognised forms; and in the numerous native languages, in regard to which an endless amount of work yet remains undone. The institution of a chair of phonetics was therefore suggested, and next in importance would be chairs for the systematic study of the country's aboriginal languages. Then chairs of ethnology should be added, and all this calls for speedy attention, as witness the opportunities passing, never to be recalled, with the fast disappearing Hottentots and their curious and interesting language and ethnological connections.

Of the papers read at the sectional meetings, in Section A a great deal of interest attached to a series of spectrographic investigations of the N'Kandhla meteorite and other meteoric irons by Dr. J. Lunt, of the Royal Observatory, near Cape Town. Several measurements of wave-lengths demonstrated that the lines observed were yielded by cobalt, nickel, chromium, iron, and barium. No evidence was found of the presence of magnesium, platinum, or copper. Mr. E. Jacot contributed the results of experiments made at the South African College with respect to atmospheric radio-activity. The activity of a wire charged with a high negative potential was least after rain and highest after S.E. winds. Per unit volume of air there was 28,000 times as much of the emanation of radium as of thorium.

In Section B Dr. W. Johnson contributed a paper embodying further experiments made by him in regard to the origin and formation of the diamond, which, he is convinced, could not possibly have taken place in a rock in molten condition. "The lost land of Agulhas" was the subject of a paper by Prof. E. H. L. Schwarz, whose theory is that the flagstones and clay slates of the Cape Peninsula were formed by denudation from a now submerged land to the south of the present continent. Four papers on geological subjects were submitted by Dr. W. Versfeld, the most important of which was one which recently gained him his doctorate from the Cape University—"The Geological Structure of Parts of German South-West Africa." Dr. C. F. Juritz read a paper on the investigation of plant poisons in South Africa, detailing the results of numerous analyses, many of which indicate active principles new to science. The great importance of systematically investigating this subject was urged. Another instructive paper, by Mr. C. Williams, dealt with the chemical control of cattle-dipping tanks.

The Rev. J. A. Winter contributed to Section C a suggestive paper on native medicines, and urged that the Agricultural Department should devote its attention to the indigenous plant remedies employed by "Kaffir doctors." Dr. Perold and Mr. Crawford contributed a comprehensive series of analyses of vineyard soils from the Montagu and Robertson districts. Mr. F. W. FitzSimons detailed the results of experiments with banana stem juice and other alleged snake-bite remedies, all of which failed to produce the curative effects ascribed to them.

Several papers in Section D were devoted to native manners and customs. The Rev. W. A. Norton dealt with the study of the South African native languages, and in the course of his address he pleaded earnestly for a scientific study of comparative Bantu. Miss Wilman exhibited a magnificent collection of actual-size reproductions of Bushman paintings and rock engravings. The Rev. J. R. L. Kingon, of the U.F.C. Mission, Somerville, contributed a paper on the emergence and progress of the Transkeian natives, ascribing to the passing of communal land tenure, *inter alia*, the vast change that was taking place. He emphasised the desirability of instituting individual tenure, so that economic pressure, supplemented by the establishment of a native university, might complete the improvement in the status of the natives who were being rapidly Christianised. The Rev. Noel Roberts submitted a paper on the practice of the To-Kolo system of divination amongst the natives of the northern Transvaal, and a contribution by Mr. H. W. Garbutt on the resemblance between the utensils of the ancient Egyptians and those found in Northern Rhodesia was likewise of great interest. Mr. Garbutt also contributed some notes on the natives of Rhodesia. "The mental and moral capacity of our natives" was exhaustively dealt with by the Rev. J. A. Winter, who has resided for fifty years amongst the natives of eastern Transvaal.

Other papers of interest read in Section D included suggestions for the constitution of an Upper House of Parliament, by Dr. A. H. Watkins, the main suggestion being that admission to the franchise be restricted to persons of advanced years. A valuable paper on South African place-names was read by the Rev. Charles Pettman, and one equally valuable, although in a totally different sphere, was given by Dr. T. B. Muller on some defects common to epistemological idealism and realism.

An evening discourse was delivered in the Kimberley City Hall on Friday, July 10, by Prof. E. H. L. Schwarz, on the Kimberley diamond pipes, the history of their discovery, and their relation to other South African volcanic vents. This lecture, like Prof. Marloth's address as president of the Association on Wednesday, July 8, was illustrated by many lantern slides. The numerous slides exhibited by Prof. Marloth were all exquisitely hand-coloured, and constituted without doubt the most excellent collection representative of South African indigenous flora ever exhibited. They were specially prepared by Dr. Marloth for this occasion. At the conclusion of the president's address, Dr. Crawford, the association's senior vice-president, handed to him the South Africa medal (instituted by the British Association in 1905 in commemoration of its visit to South Africa during that year) and grant of 50*l.* which had been conferred upon him in recognition of his eminent services to botanical science in South Africa during the last thirty years.

C. F. J.

THE MUSEUMS ASSOCIATION.

SWANSEA CONFERENCE, JULY, 1914.

THE Museums Association fittingly celebrated the completion of a quarter of a century's existence by an incursion into a hitherto unvisited country—the Principality of Wales—Swansea being chosen as the meeting place.

The attendance was very large, and the papers and discussions reached a high standard of excellence. Particularly noteworthy were those dealing in a practical way with the preservation and restoration of works of art—a subject which has never previously received so much attention at an annual conference.

Representatives were sent by forty provincial museums and art galleries, five national museums (the British Museum, the British Museum of Natural History, the Victoria and Albert Museum, the National Museum of Wales, and the Museum of the Royal Botanic Gardens at Kew), and the London County Council.

The presidential chair was occupied by Mr. Charles Madeley, Director of the Warrington Municipal Museum.

In his presidential address Mr. Madeley invited the conference to consider "What is the true theory of a municipal museum?" To the community which desires to establish or to re-organise a museum, this is a vital question, and the president dealt with it in a manner at once comprehensive and illuminating. Municipal museums are mercifully free from any kind of departmental regulations restricting their scope and activities, but this blessing has in the past been a somewhat mixed one, and one of the great functions of The Museums Association is to see that it is henceforth properly appreciated.

The president suggested that a museum might be defined as "a collection of specimens *arranged with a purpose*," and objected to that purpose being defined as "educational," by reason of the unattractive nature of the word and the unnecessary limitations imposed by it. This objection was the source of some misunderstanding on the part of those hearers who did not grasp the true significance of Mr. Madeley's remarks, although he made it abundantly clear that a museum must, in his view, be educational. The contents of the ideal museum should, according to the president, constitute a miniature or synopsis of the universe—the true microcosm, in fact—but with the great and essential difference that, in the museum, things are classified, and therefore intelligible, whilst in the world outside they are not. He quoted with approval the statement of Dr. Brown Goode that a museum should be "an institution for the preservation of those objects which best illustrate the phenomena of nature and the works of man, and the utilisation of these for the increase of knowledge and for the culture and enlightenment of the people."

The text being thus provided, there arises the necessity for a full and sound classification of the whole of the possible contents of such a museum.

Classifications, which might be thought suitable by some, have been prepared for the use of librarians, but the president pointed out that these are too arbitrary. In a library, where classification exists merely to promote ease of reference, this does not matter, but an orderly and logical conspectus is absolutely necessary when one of the great properties of the institution is "visualisation," as in the case of museums.

A filling-out of the broad scheme, drawn up by Brown Goode, is the kind of thing required. In it different points of view would be provided for, and the president called attention to one which has long suffered under an unjust stigma—namely, the economic point of view. "We may hope," said he, "that technology, and eventually even commerce, may meet with adequate recognition in the museum."

Mr. W. Grant Murray, Director of Art in Swansea, then gave an interesting account of the rise of the school of art and crafts and of the two local art galleries.

Dr. H. Langton related some of his experiences in the preparation of the skulls of birds by means of the sand-process. His remarks brought forth a champion of the old water-maceration method, in the person of Mr. A. W. Gunn, of Newport, and it seemed fairly obvious from the discussion that, as in most matters, there is no one universally applicable method.

Mr. B. H. Mullen gave an account of the "Children's room" at the Salford Museum, which has been established with the intention of providing a series of introductions to the various major collections, and to bring young people into intelligent and sympathetic touch with them.

The Bankfield Museum publications were the subject of a note by the curator, Mr. H. Ling Roth.

On the evening of Tuesday, July 7, Mr. E. Rimbault Dibdin, curator of the Walker Art Gallery, Liverpool, delivered a public lecture on "Wales and the Fine Arts, Past, Present, and Future."

Mr. E. Howarth opened a discussion on the subject of "The Museum and the Schools," in which he emphasised the great desirability of these rapidly developing institutions keeping in close touch. There should be greater collaboration between the curator and the teacher in order that the curator's work may be of a nature to deserve and receive a full measure of use and appreciation by members of the scholastic profession and their charges. Mr. Howarth alluded to the importance of the kinematograph as a force in school teaching, and, as it is scarcely possible to have a kinematograph in every school, he suggested that every municipal museum might usefully instal an instrument to exhibit films germane to the work of the institution.

A demonstration of the characteristics—colour, translucency, etc.—of the various types of porcelain formerly made in Swansea and neighbourhood was given by Mr. Herbert Eccles.

Mr. Quick, under the title "The Protection and Restoration of Pictures," gave a number of hints on the care and treatment of paintings, drawings, and engravings.

Mr. Williams's paper on "The Renovation and Restoration of Oil-paintings, with Practical Experiments," was illustrated by some examples of "before and after" treatment.

Dr. H. S. Harrison, of the Horniman Museum, in a paper entitled "Ethnographical Collections and their Arrangement," advised the adoption of what has been described as the "topical" mode of arrangement, and showed by means of well-chosen lantern slides how the evolution of processes, utensils, instruments, etc., might be advantageously illustrated.

Some points in the construction and fittings of the new King Edward VII. galleries at the British Museum were described by Mr. R. A. Smith.

The final paper was one in which there was every evidence of a serious premeditated intention to fit a museum building for the purpose of adequately and comfortably displaying the objects to be housed in it. We refer to the design for the new museum and art gallery at Belfast, which was lucidly described by Mr. Arthur Deane. Here the curator and architect have evidently been in close collaboration, and have produced a design original in several features and full of promise.

The entertainment and hospitality meted out to the Association by the Mayor and Corporation of Swansea and the leading citizens were of a most lavish and thoroughly enjoyable character, and the local arrangements were carried out by Mr. W. Grant Murray with a smoothness and precision which have never been surpassed.

The Association, at its business meeting, elected a distinguished worker on the art side—Mr. E. Rimbault Dibdin—to be president for 1914-15.

THE HARDENING OF STEEL.

AT the May meeting of the Iron and Steel Institute two papers were read and discussed dealing with the theory of the hardening of steel; they gave rise to one of the most interesting discussions of the meeting. While it is, of course, obvious that the more "practical" members of the institute take no interest in these discussions, it must be borne in mind that the theories of to-day become the foundations of the practice of to-morrow, and that therefore the "practical" man cannot in the least afford to despise or ignore what he likes to dismiss as "mere theory."

The two papers on hardening presented to the institute both put forward fairly definite theories, and at first sight these differ entirely from one another and still more from the older purely "allotropic" theory of hardening. It was interesting to find, however, that during the discussion not a single advocate of the other older theory—that of the so-called "carbonists"—came forward. When the views put forward by Profs. Edwards and Carpenter and by Mr. McCance are carefully compared, however, it will be found that they do not really differ very vitally either from one another or from the older allotropic view. All three theories agree in supposing that when carbon steel is cooled rapidly an essentially unstable transition product is formed which is itself intrinsically hard. The allotropic theory called this intermediate hard product "beta iron," and identified it with the beta iron which has a limited range of stable existence in pure iron and in low-carbon steels; Messrs. Edwards and Carpenter and the writer now identify it with the "hard amorphous phase" of Beilby, while Mr. McCance invents a new word and calls it "interstrained" iron. The real difference of opinion seems to centre on the question how this intermediate substance comes into existence.

Profs. Edwards and Carpenter approach the subject from the point of view of an analogy between the hardening by quenching of steel and of alloys of copper containing from 10 to 13 per cent. of aluminium. These latter are somewhat hardened by quenching, and there is a corresponding similarity, on broad lines, between the respective constitutional diagrams; by quenching, both kinds of alloys are caused to pass rapidly through a transformation range. The resulting micro-structures also show a certain similarity, the aluminium-copper alloys exhibiting an acicular structure having some resemblance to the coarser kinds of martensite seen in hardened steels. The authors then endeavour to show that the structures of both quenched aluminium-copper alloys and of quenched steel arise from an identical cause, viz., highly multiplied twinning, which they believe to occur during quenching as a result of the internal strains caused during rapid cooling. The evidence that the martensite of steel is really equivalent to highly twinned austenite is, however, very weak, and it has yet to be proved or even shown to be likely that quenching can produce multiple twinning. In the discussion of this paper, the writer pointed out that to produce notable strain-hardening of a plastic metal by deformation needed the application of really large deformations, while, on the contrary, the amount of deformation (*strain* in contradistinction to internal *stress*) which could be caused in steel by quenching must be very small. It is further a very open question whether strain really ever produces direct twinning in a metal. Finally, it has yet to be shown that a twinned constituent is really materially harder than in the untwinned condition; the softness and ductility of such materials as rolled and annealed copper or brass, which are one mass of twinned crystals, points in the opposite direction. The idea put forward by Edwards and Carpenter that amorphous layers are formed on the twin boundaries in the process of twinning was well refuted by Mr. Humfrey in the discussion, as he showed by means of models that twinning could and did occur without disarrangement of the space-lattice at the boundary. As a result of the whole discussion it appeared that the authors had attached altogether too much weight to the process of twinning, but that the formation of amorphous metal during the quenching process might well be looked upon as the real cause of hardening—a view which the late F. Osmond had put forward quite clearly a year or so before his death.

Mr. McCance's paper began a thoughtful consideration of the whole subject by a review of existing theories. Both in regard to the existence or otherwise of beta iron as an independent allotropic modification, and in regard to the amorphous theory, however, the author made the mistake of considering that the objections which he raised can settle the point and dispose of these theories in half a dozen words. The question as to the extent and nature of the differences between alpha and beta iron is still being closely discussed, and even if Weiss's magneton theory finds ultimate acceptance, it is still a question whether the magnetic transformations do not really constitute one type of allotropy, nor is it yet certain that they may not be associated with far-reaching changes in other properties. Again, as regards the amorphous theory, Mr. McCance's objections are based on a simple misunderstanding, coupled with an assumption, based on the magneton theory, which has yet to be justified. This assumption amounts to the view that only crystalline solids can be ferro-magnetic, and that consequently amorphous iron would necessarily be non-magnetic. Facts are, however, against this view, for colloidal suspensions of iron are strongly ferro-magnetic, and so are a number of oxides and salts of iron, some of the latter even in a state of solution.

Of much greater value are Mr. McCance's experimental studies of hardening in carbon steel, which lead him, finally, to put forward a theory of the hardening of steel by "interstrain," which is practically a translation of Osmond's view ascribing the hardness of quenched steel to the presence in it of "le fer alpha écroui." It is only Mr. McCance's account of the nature of "interstrained" iron which it is difficult to accept. Declining to accept the views of Beilby and of Rosenhain as to the hardening of strained metals by the formation of layers of the amorphous phase, the author uses the word "interstrain" to denote a condition in which the regular crystalline arrangement is broken up generally, leaving a mass of irregularly arranged crystal fragments. It may well be asked what it is that holds these irregular and ill-fitting fragments together, and why an aggregate of such fragments should be harder than the aggregate of the larger pieces of crystal which constitute the ordinary soft metal? But beyond this

there is the experimental evidence; both strain-hardened metal and quenched steel on etching exhibit the well-defined oriented lustre of a crystalline aggregate, thus clearly showing that the crystals are not disarranged into minute irregular fragments. It would seem, therefore, that Mr. McCance's conclusions must be narrowed down to this, that the hardness of quenched steel is due to the same cause as the hardness of strain-hardened iron, and this—but for a difference as to mode of origin—is also the view of Edwards and Carpenter. In this narrowed conclusion, however, there is a distinct step forward, since we have a definite "explanation "of the hardening of steel in the sense that this phenomenon is correlated with the much larger class of phenomena which occur when any soft or ductile metal is hardened by plastic strain. If we accept the possible existence of the amorphous phase, it is easy to express both classes of facts in a single and simple formula, and this in itself constitutes another argument in support of the amorphous theory. Whatever view one may take of these admittedly hypothetical matters, it seems that a definite advance has at last been made in our knowledge of the hardening of metals.

W. ROSENHAIN.

SCHOOLS AND EMPLOYERS IN THE UNITED STATES.[1]

MISS WINEFRID JEVONS gives in the report before us an interesting account of the history and present position of the relations between the schools and industrial employment in the United States.

The most important lesson to be learnt from the report is, perhaps, that in the United States employers and trade unions have realised, to a much greater extent than in this country, the necessity for part-time day classes for persons engaged in industry and commerce. Not only does the American Confederation of Labour take this view, but the National Association of Manufacturers also favours it. Indeed, the latter body went so far in 1912 as to recommend compulsory continuation classes, until the seventeenth or eighteenth year, one half-day a week, without loss of wages.

In this country there are some firms (comparatively few in number) who have had the wisdom to see that it is not only in the interest of the people they employ but also in their own interest to liberate young persons a certain number of hours a week, in order that they may in the daytime receive proper part-time instruction directed to make them more efficient in their respective industries; but we are still far from so wide and generous a belief in the value of education as the resolutions of the National Association of Manufacturers show to be prevalent in the United States.

The existence of such a wholesome state of public opinion accounts for the large amount of voluntary and compulsory part-time instruction which is to be found throughout the States; many instances of this are given in the report. In Massachusetts, a law has been enacted which enables local authorities to open day continuation classes for the education of children between fourteen and sixteen who are in regular employment, and to compel attendance at these classes in the daytime for not fewer than four hours a week; the time spent in the school is counted as a part of the number of hours that the child is permitted by law to work. The State provides half of the cost of the maintenance of the classes.

In the States of Ohio and Wisconsin, compulsory day continuation classes are in existence; in the latter State, apprentices may not be employed for more than 55 hours a week, and the employer must liberate the apprentice five of these 55 hours a week in order that he may attend a day continuation school.

J. W.

[1] Board of Education. Special Reports on Educational Subjects, vol. xxviii.

SEISMOMETRY AND ENGINEERING.[1]

IN the memoir before us we have a gratifying proof that practical engineers realise the importance of the application of the principles of instrumental seismometry to building construction. The immediate object in the present investigation is the vibration set up in a large masonry bounding wall of a reservoir in Queistal, Schleswig. This wall stretches between rocks across a narrow valley, and the overflow of water, estimated at 100 cubic metres a second, falls about 40 metres. Thus an enormous amount of vibrational energy is set up.

The destructive action of vibration on a structure is probably determined by the maximum acceleration experienced, and thus short-period vibrations are often more serious than long-period vibrations of larger amplitude. Prof. Grunmach first describes and discusses an apparatus designed to give the maximum acceleration, and then goes on to describe the arrangements for investigating the period and amplitude. These are really seismographs for measuring the horizontal and vertical components of motion. They are based on precisely the principle of electromagnetic registration introduced by Prince Galitzin for earthquake recording. The apparatus differs from Galitzin's in detail considerably, since the periods and amplitudes to be measured are very different from those experienced by the passage of earthquake waves. Continuous registration was made, and excellent diagrams of the results are given. It appears that the periods ranged from about 0·03 sec. to 0·003 sec., and the amplitude from 0·001 mm. to 0·00005 mm.

The theoretical discussion of electromagnetic registration given appears somewhat inadequate. The author adopts what may be called an equilibrium theory instead of a dynamical one. It is possible that this may be accurate enough in the case considered, but one would like a demonstration that this is so.

The memoir will no doubt be appreciated by engineers and seismologists alike. G. W. W.

[1] "Experimentaluntersuchung zur Messung von Erderschütterungen. By Prof. L. Grunmach. Pp. 102. (Berlin: Leonhard Simion Nf., 1913.

RECENT BOTANICAL WORK IN DENMARK.

AT the general meeting of the Danish Botanical Society in 1912 it was decided to publish in the future two distinct journals. One of these is the *Botanisk Tidsskrift*, the society's old periodical, which has reached its thirty-third volume, and contains chiefly papers on the Danish flora, besides articles on subjects of more general botanical interest. This will continue on its former lines, being written mostly in Danish, though occasionally—much too rarely, it may be said, for non-Danish readers—with abstracts in English, French, or German. The second journal is a new venture, the *Dansk Botanisk Arkiv*, published at indefinite periods, and containing monographs and other special articles in either of the four languages mentioned. Both journals are sent post free to members of the society, membership being open to all on payment of 10 kronen (11s.) a year; the subscription for the *Botanisk Tidsskrift* alone is 6 kronen, and the numbers of the *Arkiv* may be pur-

chased separately. We have received from the society copies of the 1913 numbers of the new journal, and some of those of the old one, besides two reprints from the *Mindeskrift for Japetus Steenstrup*, published in 1913 and 1914.

These publications form sufficient testimony to the high standard of excellence maintained by the large output of papers by Danish botanists. The mantle of the distinguished veteran of Danish botany, Prof. Eugene Warming, has fallen upon the shoulders of C. Raunkiaer, who two years ago succeeded Warming as professor of botany in the University, and director of the Botanic Garden and Museum at Copenhagen, and who has already, like his predecessor, done brilliant work on the ecology of plants. In the 1913 *Tidsskrift*, Raunkiaer has a long paper on the plant ecology of the Skagen district, in which he applies his system of "life-forms" to the statistical study of the various plant communities. An account of Raunkiaer's methods of ecological study was given by Dr. W. G. Smith in the *Journal of Ecology*, vol. i., 1913, pp. 16–26, in which the value of Raunkiaer's system was pointed out. Ecology bulks largely in this, as in former volumes of the *Tidsskrift*, but while the Danish botanists have done so much for this department of the science they have by no means neglected other branches. Their systematic investigation of the flora of the Danish West Indies has yielded a large and valuable series of monographs, while they have done more detailed and intensive work on the vegetation of Denmark than has yet been carried out in any other area of similar extent, and the work of Ostenfeld, Borgesen, Paulsen, and others on the marine vegetation of the northern seas, and on the plankton in particular, is too well known to botanists generally to need more than passing mention here.

The first four parts of the new journal are occupied respectively by a list, in Danish with Latin diagnoses, of diatoms collected by Borgesen in the Danish West Indies; an account in English of the growth-forms of some plant formations of Swedish Lapland, by M. Vahl, who proposes a system of ecological nomenclature for plant formations according to the dominant growth-forms distinguished by Raunkiaer (a summary of Vahl's useful paper is given in *Journal of Ecology*, vol. i., pp. 304–6); a long paper in Danish on the ecology of lichens, with 240 illustrations, by O. Galloe, unfortunately without a summary in another language; and a valuable monograph of the marine algæ (part i., Chlorophyceæ) of the Danish West Indies, in English, and with a chart and 126 fine illustrations, by F. Borgesen. The last-named (Bind i., No. 4, price 4 kronen) is of much more than merely systematic or algological importance, for Borgesen devotes 146 of his 158 pages to detailed descriptions of the Siphoneæ, a group of algæ of peculiar morphological and biological interest, and exhibiting the extraordinary complexity of form and structure attained by plants which are built up of cœnocytic or incompletely septate filaments.

With these four papers the *Dansk Botanisk Arkiv* has certainly made an excellent beginning, and the only criticism that occurs to an English botanist is that *all* papers written in Danish should be furnished with a generous summary in English or French or German. In this connection one may remark that despite all that has been written and said concerning the advisability of the use of one or other of the three most widely read languages in scientific literature, pending the arrival of the golden age of one universal speech, there is apparently an increasing rather than diminishing tendency for scientific workers in the smaller countries, or those whose language is little known outside their own frontiers, to publish in their own tongue.

There are, of course, many sides to this question, local patriotism and other considerations having to be taken into account, but it is certainly inconvenient and often exasperating to come across publications in languages such as Russian, Czech, the Scandinavian tongues, etc., with either the baldest summary, or in many cases none at all, in the more widely read languages. Life is too short for the acquisition of even a fair working knowledge of so many tongues; summaries or reviews in the familiar languages may or may not be published sooner or later in the *Centralblatt* journals, and are often very meagre indeed; and meanwhile one hesitates to take the thing to a translator—it may prove of no special importance for one's purpose after one has taken the trouble or expense involved. The remedy is simple enough: a scientific worker whose native language is not English, French, or German, should take the trouble to master one or other of these languages sufficient to be able to append a good summary to his paper. Failing this, a reversion to the old custom of publishing in Latin might be advocated.

The two reprints from the J. Steenstrup memorial volume are devoted to accounts of the species of Sargassum found on the coasts of the Danish West Indies, with remarks upon the floating forms of the Sargasso Sea, by Borgesen, in English; and of the distribution and reproduction of the common eel-grass or grass-wrack (*Zostera marina*) in Danish seas, by Petersen, in Danish. F. C.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The war will have a serious effect upon the University during the coming session. The whole of the new buildings at Edgbaston have been taken over by the War Office, and now form the First Southern General Hospital. Certain structural alterations are being carried out with a view of making the hospital as efficient as possible. The size and situation of the buildings and grounds, and their proximity to railway and canal, render them especially suitable for the present purpose.

CAMBRIDGE.—Mr. W. L. Bragg, son of Prof. W. H. Bragg, has been elected to a fellowship at Trinity College. He gained first-class honours in the Natural Science Tripos, with distinction in physiology.

A SCHOOL of public health is to be established at the University of Minnesota.

DR. T. SHENNAN, pathologist to the Royal Infirmary of Edinburgh, has been appointed Regius professor of pathology in the University of Aberdeen, in the place of the late Prof. G. Dean.

THE new session of the medical faculty of the University of Manchester will be opened on October 8 by an address by Prof. E. S. Reynolds on the industrial diseases of Greater Manchester.

THE Bissett-Hawkins memorial medal of the Royal College of Physicians of London has been awarded to Sir Ronald Ross, for his work in connection with malaria, and the Sir Gilbert Blane medal of the Royal College of Surgeons of England has been awarded to Surgeon G. F. Syms, R.N.

IT is announced in *Science* that Prof. C. H. Eigenmann has been appointed research professor of zoology in the Indiana University, and that he proposes to devote the greater part of the time at his disposal in completing his studies of the distribution of the fishes of western Ecuador and western Colombia and

its bearing of this on the east and west slope fauna of Panama. He intends to spend the coming winter months in correlating the fresh-water fauna of the lesser Antilles to that of South America.

THE Board of Education has issued (Cd. 7535) a new edition of its building regulations for secondary schools, being principles to be observed in planning and fitting up new buildings in England. The last issue was made in 1907, and experience has shown that a fresh statement of principles and of their application is required. The principal modifications in the present issue relate to the position of the assembly hall in relation to the class-rooms, the need of making provision for physical training in every new school, the arrangement of cloak-rooms, and certain details in connection with art and science rooms, housecraft rooms, and staircases.

THE prospectus of the university courses in the Municipal School of Technology, Manchester, for the forthcoming session has been received. It will be remembered that the Manchester Technical School forms part of the Victoria University of Manchester, and provides for the faculty of technology. The courses described in the prospectus lead to the degrees of Bachelor and Master of Technical Science. These courses are controlled by the Senate of the University, through the board of the faculty of technology, which is composed of the heads of departments in the school of technology together with certain other professors and lecturers in the University. The degrees may be taken in the following divisions of technology: mechanical, electrical, or sanitary engineering; applied chemistry; mining; architecture; and textile industries. Courses of post-graduate and specialised study and research have been arranged for students who have graduated.

AN interim report of the Joint Committee of the Illuminating Engineering Society and other bodies on "The Natural Lighting of Schools" appeared in the July number of *The Illuminating Engineer*. Among the suggestions we note:—(1) No place is fit for use in a schoolroom when diamond type cannot be read easily by a normal observer at a distance of half a metre; (2) the darkest desk should receive not less than 0·5 per cent. of the unrestricted illumination from the complete sky hemisphere; (3) windows should be to the left of the pupils. Other recommendations refer to details such as the colour of walls, furniture, etc. A point deserving special attention is that most light is needed in the infant class-rooms, which at present are usually less efficient as regards lighting than any other schoolrooms. The Committee consider that the Building Regulations (1907) of the Board of Education have produced good results, but find, nevertheless, many points which require further investigation. In view of the extensive character of the research, it is hoped that local authorities will be willing to assist. The Committee is of a thoroughly representative character, and has obviously proceeded with judicious care so far; we are glad to see that the Society intends to issue a reprint of this report, together with notes on Continental research and the corresponding interim report on the Artificial Lighting of Schools, issued last year.

THE handbooks for next session of the faculties of engineering and of the medical sciences at University College (University of London), Gower Street, W.C., have now been issued. The faculty of engineering, of which Prof. J. A. Fleming is dean, includes the departments of civil and mechanical engineering, electrical engineering, and municipal engineering, and is intended to provide for students wishing to devote themselves to engineering a systematic training in the application of scientific principles to industrial purposes. The courses are also suited to the requirements of students who intend to enter for appointments in the Indian Public Works Department, engineering department of the General Post Office, department of the Director of Engineering and Architectural Works in the Admiralty, Patent Office, and other similar services. The departments have been recognised by the Board of Trade as providing suitable technical training for marine engineers. Facilities are provided for post-graduate and research work in all the subjects. The faculty of medical sciences, of which Prof. A. R. Cushny is dean, comprises the departments of physics, chemistry, botany, and zoology—the preliminary medical sciences; also the departments of anatomy, physiology, and pharmacology—the intermediate medical science; and the departments of hygiene and public health, and of pathological chemistry for post-graduate study. All communications concerning these courses should be addressed to the Provost, University College, London.

SOCIETIES AND ACADEMIES.

EDINBURGH.

Royal Society, July 6.—Prof. James Geikie, president, in the chair.—Dr. George **Philip**: Obituary notice of John Sturgeon Mackay.—Dr. E. M. **Wedderburn** and A. W. **Young**: Temperature observations in Loch Earn. Part ii. The observations discussed were made in August, 1913, and supplied a good example of a temperature seiche. The decay of the oscillations was very rapid. Periodogram analysis indicated periods of twenty hours and ten hours. Calculation of the probable period from the mathematical theory gave a period of 19·6 hours for the principal oscillation. The records were also subjected to harmonic analysis, and the effect of light winds in altering the character of the oscillation was clearly demonstrated.—D. **Ferguson**, G. W. **Tyrrell**, and Prof. J. W. **Gregory**: Contributions to the geology of Louth. The valuable collections made by Mr. Ferguson were studied and described by Mr. Tyrrell, who gave a general petrographical report. In a further report Prof. Gregory considered the general geological problems suggested.

PARIS.

Academy of Sciences, July 27.—M. P. Appell in the chair.—Mlle. Th. **Tarnarider**: The best approximation of $x^k|x|$ by polynomials of indefinitely increasing degrees.—René **Garnier**: The representation of the integrals of Painlevé's equations by means of the theory of linear equations.—César **Spineanu**: The development of a holomorph function in series of inverses of polynomials and in series of rational fractions.—Georges **Rignoux**: An arrangement for vision at a distance. A description of a system of relays in connection with a number of selenium cells.—Maurice **de Broglie**: The spectral analysis by the secondary rays of the Röntgen rays and its application to the case of rare substances. As the method of examination, described in an earlier communication, can be applied to very small quantities of substance, the oxides of gallium and germanium have been examined. Figures are also given for antimony, tin, and lanthanum.—Henri **Labrouste**: Monomolecular layers and surfusion. A study of the solidifying points on trilaurin, tribenzoin, and trimyristin in very thin layers.—J. **Guyot**: The Volta effect and monomolecular layers. Measurements of the differences of potential appearing at the contact of gold and water when extremely thin layers of various organic substances are floating on the

surface of the water.—R. **Boulouch**: The general condition of stigmatism in a system of diopters of revolution round a given axis.—MM. **Massol** and **Faucon**: The absorption of ultra-violet radiations by the chlorine derivatives of methane. Pure carbon tetrachloride gives no absorption band, and the band ascribed to this substance by several observers has been traced to the presence of carbon disulphide. Chloroform and dichloromethane also give no absorption bands.—J. **Larguier des Bancels**: The photochemical properties of the coloured resinates.—Ch. **de Rohden**: The constant presence of rare earths in scheelite as shown by cathodic phosphorescence. In scheelites of different origin a study of the phosphorescence spectrum has shown the presence of samarium, dysprosium, erbium, terbium, europium, neodymium, and praseodymium. All the elements to which the method is applicable have been found, but the relative proportions of the rare elements differ considerably from one scheelite to another. All the spectra found can be explained with the known rare elements.—Marcel **Duboux**: The estimation of potash and magnesia by a physico-chemical volumetric method. Application to the analysis of wine. The method is based on the changes of electrical conductivity produced by the gradual addition of an appropriate reagent.—J. **Blumenfeld** and G. **Urbain**: The isolation of neoytterbium. As a criterion of purity of a fraction, the magnetisation coefficient possesses advantages over the usual spectrum methods. This has been applied to the products resulting from a long series of fractionations of the earths of the ytterbium group, and the name neoytterbium has been given to one of the earths isolated in this way. It is defined by its magnetisation coefficient, spectrum, and atomic weight (173·54).—André **Brochet** and André **Cabaret**: The addition of hydrogen in the presence of nickel at atmospheric pressure to compounds with fatty ethylene linkings. Details of experiments on the hydrogenation of 1-octene, cinnamic acid and its derivatives, allyl, alcohol, anethol, isosafrol, and some unsaturated ketones.—MM. **Cousin** and **Volmar**: Some nitro- and amino-derivatives of orthocyanophenol.—F. **Jadin** and A. **Astruc**: Manganese in some springs of the central *massif*.—Julien **Loisel**: The construction of a monogram representative of the mean direction of the wind.—M. **Gazaud**: Contribution to the study of the mistral.—M. **Chifflot**: The extension of *Marsonia rosae* in cultures of roses. Precautions necessary to prevent the attack of rose trees by this parasite.—Em. **Miège** and H. **Coupé**: The influence of the X-rays on vegetation.—Mme. Victor **Henri**: Study of the metabiotic action of the ultra-violet rays. Modification of the morphological and biochemical characters of anthrax bacilli. Transmission of the acquired characters.—Mme. Z. **Gruzewska**: The action of some diastases on the dextrins.—T. **Salimbeni**: Bacteriological researches on scarlatina. A description of a new micro-organism found in the blood of fifteen out of twenty cases of the disease.

BOOKS RECEIVED.

Report of the Fourteenth Meeting of the Australasian Association for the Advancement of Science. Held at Melbourne, 1913. By Dr. T. S. Hall. Pp. xcii+751. (Sydney: Australasian Association.)

British Museum (Natural History). British Antarctic (*Terra Nova*) Expedition, 1910. Zoology. Vol. i. No. 1. Fishes. By C. T. Regan. Pp. 54+xiii plates. (London: British Museum (Natural History), and Longmans, Green and Co.) 10*s.* 6*d.*

Indian Forest Insects of Economic Importance. Coleoptera. By E. P. Stebbing. Pp. xvi+648. (London: Eyre and Spottiswoode.) 15*s.*

English Literature for Schools. The Early Life of Thomas De Quincey from his Own Writings. Edited by A. Burrell. Pp. 124. (London: J. M. Dent and Sons, Ltd.) 6*d.*

Agriculture in the Tropics. An Elementary Treatise. By Dr. J. C. Willis. Second edition, revised. Pp. xvi+223. (Cambridge University Press.) 9*s.* net.

A Manual of Mechanical Drawing. By J. H. Dales. Pp. xii+181. (Cambridge University Press.) 3*s.* net.

The Story of Plant Life in the British Isles. Types of the Natural Orders. By A. R. Horwood. Vol. ii. Pp. xiv+358. (London: J. and A. Churchill.) 6*s.* 6*d.* net.

Carnegie Endowment for International Peace. Division of Intercourse and Education. Publication No. 4: Report of the International Commission to inquire into the Causes and Conduct of the Balkan Wars. Pp. ix+415. (Washington: Carnegie Endowment.)

Department of the Interior. U.S. Geological Survey. Professional Paper 86: The Transportation of Débris by Running water, by G. K. Gilbert. Pp. 263. (Washington: Government Printing Office.)

A First School Botany. By E. M. Goddard. Pp. xiii+191. (London: Mills and Boon, Ltd.) 2*s.* 6*d.*

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Editorial and Publishing Offices:

MACMILLAN & CO., LTD.,

ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.

Telephone Number: GERRARD 8830.

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